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RESEARCH ARTICLE **Open Access**

Investigating Values of Purchase through the Green Image of Store on Impulse Purchase and Customer loyalty

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Abstract
In consumer behavior, purchase field is an interesting field for marketers and psychologists. This area investigates types of purchase and factors affecting them. In the meantime, in order to succeed in markets, understanding customers' consumption values and their impact on consumers' behavior is one of crucial issues. The aim of this study is to determine the relationship between values of purchase through green image on impulse purchase and customer loyalty. The statistical population in this study consists of customers of purchase centers of Iran in 202٤. The number of sample is estimated as 384 people. Regarding the purpose, this study is applied and belongs to descriptive- survey and correlational researches. For data collection standard questionnaire of Irene et al. was used, whose validity is determined by nominal and heuristic method and its reliability was measured by Cronbach's alpha coefficient as 0.87. For data analysis and hypothesis testing by path analysis and structural equation, LISREL software is used. The results show that there is no significant relationship between hedonistic values and materialistic values through green image of store with impulse purchase but there is significant relationship between hedonistic values and materialistic values through green image of store with loyalty.
Keywords: *Value of purchase, Green image, Impulse purchase, Loyalty.*

Introduction

The key point to success of marketing strategy, in terms of both local and global aspects, is understanding consumer behavior. Desirable consumer behaviors refer to the activities that are performed by the customer and lead to the flourishing of the brand and the achievement of its goals in the society(Ebrahimi et al., 2024). This is applicable for businesses and non-profit organizations as well as public organizations that develop laws related to market (Hawkiz, 2010). Good business is based on consumer behavior. A basic concept of marketing is satisfying the needs of consumer behavior. This need can only be met by marketers who want products and services to consumers (Solomon, 2010). Comment 2: In this regard, many companies fail to produce products that meet customer needs and preferences due to a lack of understanding of those needs. This has resulted in a decline in their market share(Nazari Ghazvini et al., 2023). Consumer behavior in today's diverse markets is influenced by various factors, including people's attitudes and perceptions about elements such as the country of manufacture(Jalalzadeh & Momeni, 2024). This research examines consumer choice and buying behavior. One of the most controversial issues in marketing and consumer behavior is the field of consumer's choice and purchase behavior. of products in their shop windows and decorating them (Solemani, 2012).

The reason for going purchase of people is that cannot be simply the satisfying desires and experiences to obtain and use the

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product.   Comment 2: On the other hand, customer satisfaction is a complex human process that encompasses cognitive and emotional factors, along with various psychological and physiological effects. This is a critical issue for the success of any traditional or online business(Hosseini et al., 2024).Edward Tapper raised in his short but influencing article. Among the responses received, he identified a number of incentives that were less associated with the act of purchase. These incentives included a set of role-playing, current entertainment of daily life, social experience outside with friends, sensory stimulation and motivation, communication or gossiping with others, interacting with friends group, enjoying the prestige and authority and ultimately the joy of bargaining (Tapper, 2010).

Campbell says purchase is enjoyable activity when one considers it in the circle of voluntary tasks (Falk, blankets, 2011). Customers who follow value of hedonistic purchase mostly seek to have joy and fun of it and describe it a random and aimless matter for their shopping experience (Hirschman, Holbork, 2011).

Impulse purchase is a complex and multifaceted concept (Herkailiglo et al., 2009). Different researchers have different definitions for impulse purchase (Parbuth, 2007). Impulse purchase is one of inclusive aspects of consumer behavior and a significant focal point for activities in marketing. These purchases that operationally are known as unplanned purchases make up between 27 and 62 percent of all store purchases. (Taheri Kia, Nokhbe Zaim, 2012). It is interesting that in Iran, less attention has been paid to the concept of impulse purchase. Therefore, in this study it is tried that this issue be further investigated, so that by identifying its results for developing marketing goals In order to gain customer and loyalty.

In the similar situation, Babin et al. define Hedonic value as perceived emotional and affective value through purchase activities. According to theory of Bruce and Baloch , consumers experience hedonistic value as experiencing functional or task to the purchase (Baloch, Bruce, 2008). Today, in stores, impulse purchase is a major source of income for them. Today, customers do increasing volume of these purchases that some researchers has studies this phenomenon as a different individual variable recently (Abassi, Jafari, 2011). For this reason, the role of stores is rising increasingly and stores are also looking for different ways to increase the number of purchases. Comment 2: Store managers should always monitor their interactions with customers and provide them with a clear understanding of their needs and values, as well as the valuable goods and services offered. This approach fosters customer loyalty and satisfaction(Rostami et al, 2019). Upon rising incomes and purchasing power, impulse purchase increases and appears as a dominant consumer behavior. According to the available literature, if customers buy only when needed, market economy fails that is one of the fundamental issues present time (Darvishpour, 2011). In today's competitive market, the most important thing is different tastes of customers that are considered as important issues of organizations. Some purchase centers, by putting a variety of products in their shop window and decorating them, attract customers. So paying attention to importance of hedonistic values, difference (distinction), perceived and sense of attachment (interest) to purchase centers is one of the major requirements for administrators in recent decades (Soleimani, 2012). It was also reported that 90 percent of people do occasional impulse purchases and in some specific products 80% of the total purchase is impulse purchase (Ghaderi, Abed, 2011). Today, each customer has its own special value and purchase centers should fight to gain more share from stable or declining market (Bellinger et al., 2008). Recently researchers in their patterns and models, in order to more realistic study of purchase or consumption experience, consider emotional and hedonistic and materialistic variables too. Given the importance mentioned for perceived value of

purchase, and the important role these values play, this study is to identify the relationship between perceived values of customers (hedonism, materialism), through green image of store with the tendencies of impulse purchase and customer loyalty, because if there is a relationship, the purchase centers under study can increasing their loyalty by considering these components, and achieve advantages such as more sales and earning higher incomes. Thus, this subject is very debatable in field of behavior of Iranian consumers, on the other hand it is trying to complement previous researches and provide some solutions in this field.

Theoretical base and background of research

In today's world, to buy and consume, consume is facing a variety of products that have distinctive features from each other and somehow are able to meet some of the needs of consumers. Since companies are always looking for profit and for profit should consider customer needs and requirements, thus, consumer behavior is raised and it is one of the important topics and branches of marketing. In the field of consumer behavior types of purchases are raised one of which is planned purchase and the other unplanned purchase (Dilafruz, Taleghani, 2010).

Purchase values of customer represent transaction between quality and guarantee received in related to price paid for achieving it (Dadlz et al., 2013). Hedonistic purchase value includes entertainment, excitement and pleasure of purchase experience. Customers who follow hedonistic purchase value seek the joy and fun of it and describe good purchase a coincidence and aimless subject for experience of shopping (Solomon, 2012). Hedonistic purchase value is subjective and individual. This value can be realized through the joy and excitement, rather than achieving the goal (Hirschman, Hulborok, 2012). Materialism is defined as degree of importance people give for their material products and ownership of them. For these people, satisfaction and pleasure of life as well as judgment about progress of one

and others is on the basis of material assets. Earning money is success for them and wealth is at the center of their lives (Irene et al., 2012). Green image is positive feeling that people have with hearing the name of the store. A positive image of a business includes facts, events, history, personal and commercial advertisements that create a belief in the public mind (Kotler & Armstrong, 1988). According to existing research, environmental information positively affects consumer attitudes and increases awareness, and companies use resources to increase consumer views on the innovation and value of green brands and green image of stores in increasing consumer awareness (Sondhi et al., 2023). Consumers' intention to purchase often depends on the company's marketing strategy, the customer's attitude and importance towards the transaction. Consumers' positive feelings and attitudes toward a product/service, or specifically a store, influence their purchase intention. The intention to buy from a retail store is influenced by some external factors such as the brands sold in the store, location and timing and some intrinsic factors such as fulfilling a need, fulfilling a preference and putting the consumer in a better position (Golalizadeh, 2023). Impulse purchase is complex, sudden, involuntary and unnecessary behavior that in this behavior, high speed in decision-making process prevents wisely and tactfully reviews of all information and other options. This behavior, compared with the planned purchase, has more excitement and less precision and avoiding doing it less commonly happens (Mahmud, 2012). Loyalty is one of the strong predictors of customer retention, or in other words, business retention factors between a customer and a service provider or repurchase of a particular brand.(Dehghan et al, 2015). On the other hand, a strategy based on customer loyalty provides many benefits, especially in the conditions of high competition and complex environments.(Tabaku & Kruja, 2019)

Customer loyalty is a type of deep-seated commitment that leads to repurchase or re-

use of a specific product or service is. However, situational effects and marketing proposals potentially affect the change in consumer behavior (Oliver, 2009). On the other hand, greater customer satisfaction leads to increased customer loyalty, reduced service delivery costs, easier customer retention, and greater employee participation(Zadegan et al., 2023). Loyalty happens when customers strongly feel that the considered organization can best possibly meet their needs, so that competing organizations get out of customers considerations and they purchase exclusively from the considered organization ,(Lyvas, 2010). A commonly stated definition of brand loyalty is that "it is a consistent consumer preference for buying a brand in particular products or services, and high brand loyalty has a significant impact on sales."(Parayil Iqbal and et al., 2023).
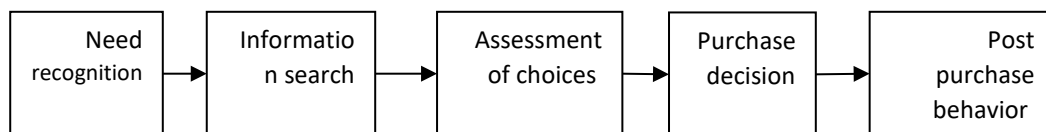
Decision making process of purchaser

Figure 1. *Decision making process of purchaser (Cutler, 2010)*

The figure above shows that the decision to buy is made up of five stages: Recognizing of need, search for information, evaluating options, purchase decision and post-purchase behavior. It is clear that purchase process starts before real purchase continues much later. Instead of focusing on the purchase decision, marketers should pay attention to whole process. According to this figure, consumer passes all five stages in every purchase, but usually in normal purchases consumers forget some steps or pass them in reverse. A woman who regularly buys toothpaste, has perceived need and by omitting the stages of data collection and evaluation, goes directly to the purchase stage.

Green image of store and the role of green image in attracting customers

Definition of the green image of the store is not easy. The image is a combination of tangible and intangible dimensions and meanings and relationships between attitudes towards store that is given to customers in the long run, (Bart, 2011). In our culture, public spaces are considered insignificant at design time and after implementation we are concerned about why the buildings are not pleasant places to visit and use by people. In designing store, not only physical design of store environment must be considered, but also all parts, pathways, entrances, parking lots, sidewalks, road facilities, lighting, furniture and public space should be supervised and controlled. Creating an appropriate atmosphere in the purchase is crucial. People want appropriate space and easy accessible to facilities (Lang, 1988). Store's location in appropriate place and building attractive and distinctive entrance for complex , creating a retreat on the sidewalk, creating a path from the corner to the purchase center, construction of convenient parking, creating perspective from different parts to the surrounding streets, connection of public sidewalks and secondary sidewalks, allocation of retreat for parking area of streets, building public social spaces on the site for success in attracting customers are decisive. Public spaces should be designed in such a way to induce the buyer a sense of community, for this purpose in the spaces common visual elements should be used (Wathiq, 2011). On the other hand, many managers motivate and direct their colleagues and subordinates to maintain a suitable environment in which all company members are directed towards the company's goals, as this also manifests itself in the store environment(Krsteska et al, 2023) The better store picture is, more

customers are attracted to it. When we want to describe concept of store image in more detail, we can divide it into two different parts, one is physical properties of products that are sold in stores such as quality, accessibility, price and psychological effects of these properties, the other interior and exterior design of sore for example store building, its space, and display screens in it (Newman, colon, 2011). Despite more complex and sensitive relations between the seller and the buyer, a trend must be continued that is economic and the profitable, so besides persistence, organizations need to have great and positive reputation for sale, employees and customers (green image). The image of organization resulting from judgment of customer's loyalty causes a halo effect. (Landystyd, 2008).

According to review of conducted researches and also based on the general principles of ideas offered, the following hypotheses are offered:

The hypotheses
(1) There is a significant relationship between the perceived hedonistic values through green image of store and impulse purchase.

(2) There is a significant relationship between the perceived materialist values through green image of store and impulse purchase.

(3) There is a significant relationship between the perceived hedonistic values through green image of store and customer loyalty.

(4) There is a significant relationship between the perceived materialist values through green image of store and customer loyalty.

Given the presented variables and hypotheses of study's conceptual model as brought in this page, it should be noted that framework of this model is taken from the issues of purchase values, green image, impulse purchase, and customer loyalty.
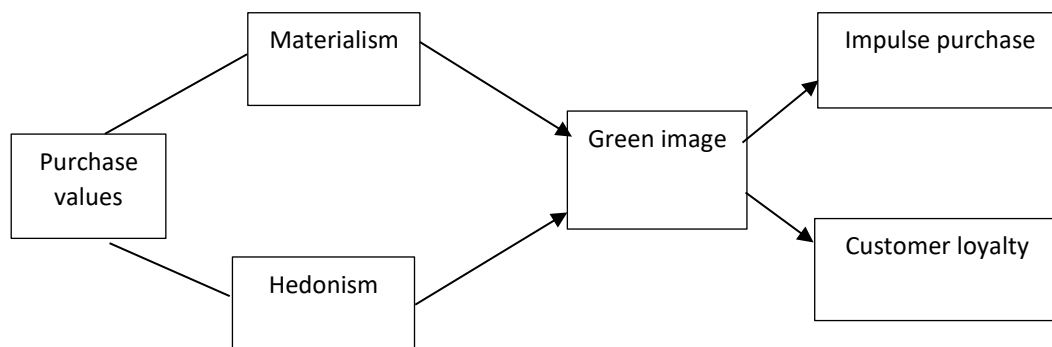
Figure 2. *Conceptual Model*
Source:Mohd,G.& Eren,s,s. & et al. (2012).The effect of green image of retailer on shopping value and loyaltyEren,S,S. & Eroglu,F. &Hacioglu,G.(2012).Compulsive purchase tendencies Through materialistic and hedonic values among college students in Turkey.

Research Methodology
Regarding nature, this study is applied research, also in terms of data collection and research conduction, it is descriptive survey. This study is correlational in examining the variable; regarding time, it is cross-sectional study and from data collection method respect it is documentary and field research method and questionnaire is used for data collection; research method is survey and it is Post-event research. In this study impulse purchase and customer loyalty are dependent variables and purchase values (hedonistic values and materialistic values) are independent variables and green image of store is entered in this research as a mediator

variable. In this study, most of setting questions was from a standard questionnaire of Irene et al (2011), but according to some conditions and to localize the questions, researchers made some changes for more ability to perceive the respondents. A questionnaire containing 30 questions was designed in two parts for questions of questionnaire are designed as package and scaled based on the five-item Likert scale for the variables from totally agree to totally disagree. The study sample consisted of all customers are purchase centers in Zanajn city. The statistical sample of this research includes customers from 7 purchase center in zanjan city that the questionnaires is distributed among them and gathered. In this

study to determine the validity of research tool face validity and exploratory tools were used. To investigate the exploratory validity of research questions, factor analysis was used.

To determine the reliability of the study questionnaire, Cronbach's alpha coefficient was used. In this study, spss software version 26 and LISREL software, version 8 were used.

Research Findings

According to the results of the first part of questionnaire (demographic characteristics), the following information are provided about the profile of the sample.

Table 1.
Descriptive statistics

Cumulative percentage	Correct percentage	percentage	percentage	Gender
۴۲/۱	۴۲/۱	۳۴/۹	۱۶۰	male
۱۰۰/۰	۵۷/۹	۴۸/۰	۲۲۰	female
	۱۰۰/۰	۸۳/۰	۳۸۰	total
Cumulative percentage	Correct percentage	percentage	percentage	age
۴/۹	۴/۹	۳/۹	۱۸	20 years and under
۴۱/۱	۳۶/۲	۲۹/۳	۱۳۴	21 to 30 years
۸۲/۷	۴۱/۶	۳۳/۶	۱۵۴	31 to 40 years
۹۷/۳	۱۴/۶	۱۱/۸	۵۴	41 to 50 years
۱۰۰/۰	۲/۷	۲/۲	۱۰	Over 51 years
	۱۰۰/۰	۸۰/۸	۳۷۰	total

Test results off testing research hypotheses are summarized in the table below:
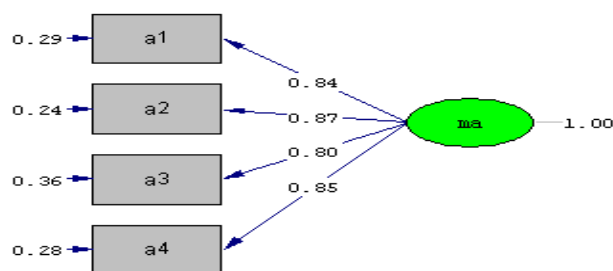
Chi-Square=0.01, df=2, P-value=0.00000, RMSEA=0.000

Model 1. *Materialistic aspect in mode*

In the second model, loyalty is measured using five indicators (items). First, factor analysis was performed on the loyalty variable with five items. Factor load of one of questions (Question 5) was below fifty percent (0.35), so the question was

eliminated and factor analysis was performed again for the remaining four questions. These items include (v4 to v1). Estimations of standardized parameter in Figure 2 shows that all indicators are statistically significant (p <0/05) and their factor loads are at a high

level (greater than 0.5). Study of fitness indicators results also indicate goodness of model fit and all fitness indicators are in acceptation area. Therefore, measurement of materialism model is accepted without any changes.

Model 2. *Materialistic aspect in mode*

In the third model, hedonism model is measured using five indicators (items). First, factor analysis was performed on variable hedonism with five items. Factor load of one of the questions (Question 5) was below fifty percent (0.42), So the question was eliminated and factor analysis was performed again for the remaining four questions. These items include (L4 to L1). Estimations of standardized parameter in Figure 3 show that all indicators are statistically significant ($p < 0/05$) and their factor loads are at high level (greater than 0.5). Study of fitness indicators results also indicate goodness of model fit and all fitness indicators are in acceptation area. Therefore, measurement of hedonism model is accepted without any changes.
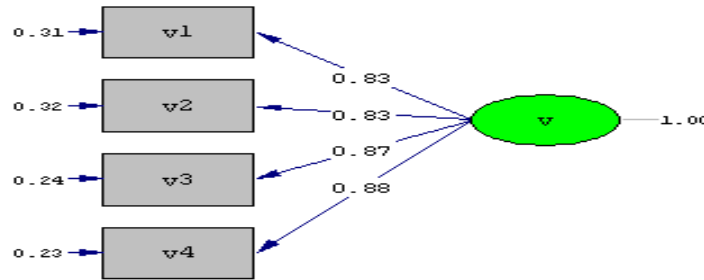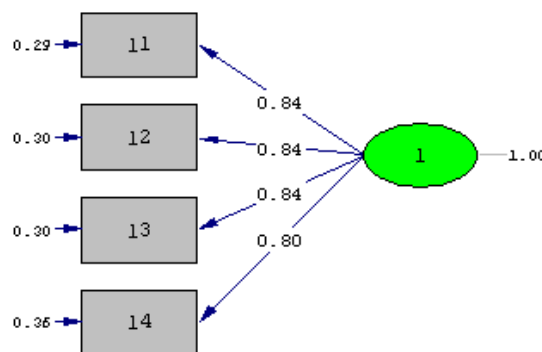

Model 3. *Materialistic aspect in mode*

In the fourth models, green image is measured using seven indicators (items). First, factor analysis was performed on the variable green image with five items. Factor load of one question (Question 7) was below fifty percent (0.45), so the question was eliminated and factor analysis was performed again for the remaining six questions. These items include (m7 to m1). Estimations of standardized parameter in Figure 4 shows that all indicators are statistically significant ($p < 0/05$) and their factor loads are at a high level (greater than 0.5). Study of fitness indicators results also indicate goodness of model fit and all fitness indicators are in accepting area. Therefore, measurement of green image model is accepted without any changes.

Chi-Square=9.80, df=5, P-value=0.01096, RMSEA=0.051
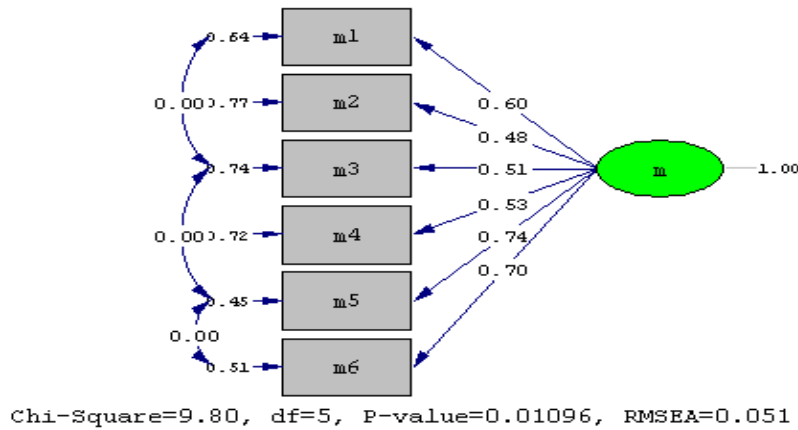
Model 4. *Materialistic aspect in mode*

In the fifth model impulse purchase model is measured using three indicators (items)   . These items include (t3 to t1). Estimations of standardized parameter   in Figure 5 shows that all indicators are statistically significant (p <0/05) and their factor loads are at a high level (greater than 0.5). Study of fitness indicators results also indicate goodness of model fit and all fitness indicators except Chi square are in accepting area. Therefore, measurement of impulse purchase model is accepted without any changes.

Chi-Square=04.44, df=3, P-value=0.0400, RMSEA=0.020
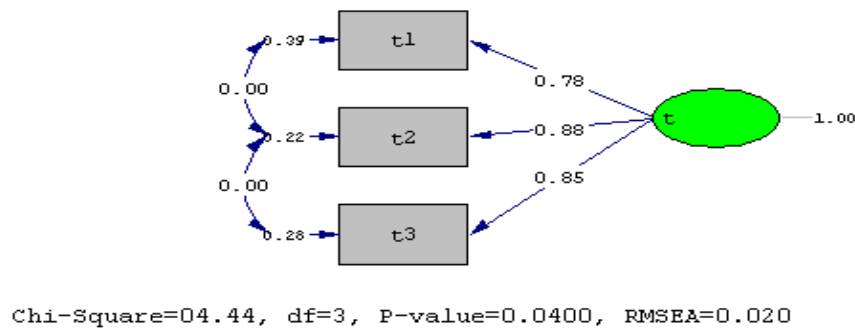
Model 5. *Model of impulse purchase aspect in mode (standard solution)*

Figures 6 and 7 are final model of this study; this model is developed according to the conceptual model and   with the support of theoretical principles. This model is in a state of T-VALUES AND STANDARD SOLUTION.

Chi-Square=260.57, df=180, P-value=0.00000, RMSEA=0.033
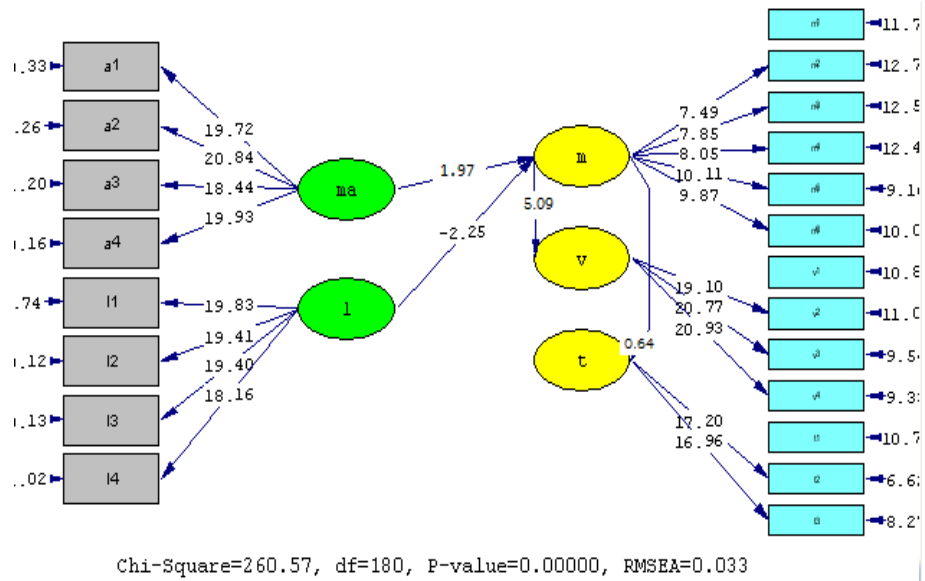
Model 6. *Structural equations model of research in mode T-VALUES*

Chi-Square=260.57, df=180, P-value=0.00000, RMSEA=0.033
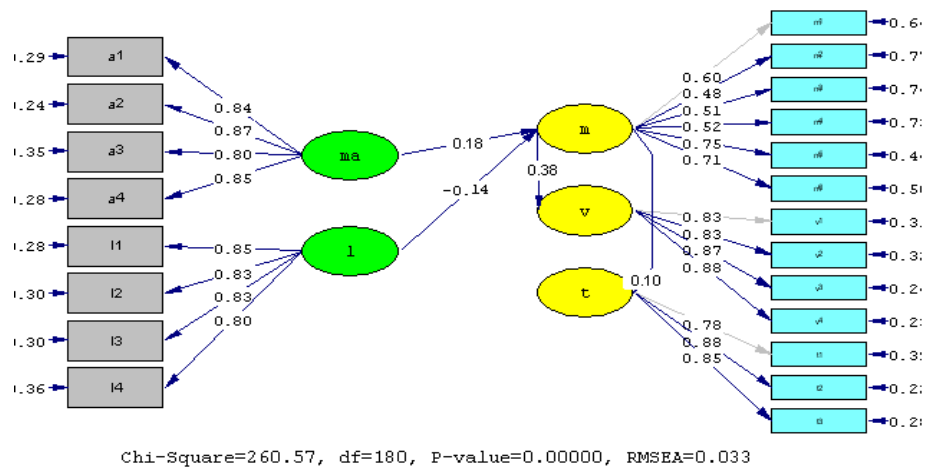
Model 7. *Structural equations model of research in mode   STANDARD SOLUTION*

Table 2 summarizes coefficients of   path model of structural equations in this study, in this table values of both models in standard and t mode are brought.

Table 2.
Summary of the most important indicators of fitness

T	Standardized coefficient B	Graphical signs	Formative-Reflective path		
۱/۹۷	۰/۱۸	ma	**Green image**	F	Materialism aspect
-۲/۲۶	-۰/۱۴	L	Green image	F	Materialism aspect
+۰/۶۴	-۰/۱	m	Impulse purchase	F	Green image aspect
۵/۰۹	۰/۳۸	m	Loyalty	F	Green image aspect
۲/۴۲	۰/۲۲	L	Impulse purchase	F	Materialism aspect
-۲/۵۴	-۰/۲۲	L	Loyalty	F	Materialism aspect
۱۵/۴۰	۰/۸۹	ma	Impulse purchase	F	Materialism aspect
۱۷/۴۰	۰/۸۷	ma	Loyalty	F	Materialism aspect

Table 3 summarizes the research findings with respect to testing the hypothesis by path analysis. As can be seen, among the four sub-

hypothesis raised by this study, only two hypotheses have been confirmed.

Table 3.
Summary of the findings of research

Hypothesis test results	Type of Relationship	Relationships	Hypotheses
Rejected	Significant	Hedonism - green image	H1
	insignificant	Green image- impulse purchase	
Rejected	Significant	materialism - green image	H2
	insignificant	Green image- impulse purchase	
Confirmed	Significant	Hedonism - green image	H3
	Significant	Green image - loyalty	
Confirmed	Significant	materialism - green image	H4
	Significant	Green image - loyalty	

Model (8) shows the final model of structural equations of research and model (9), the final model of structural equations of

research with regard to the direct influence of independent variables on the dependent variable.

Chi-Square=527.76, df=183, P-value=0.00000, RMSEA=0.070
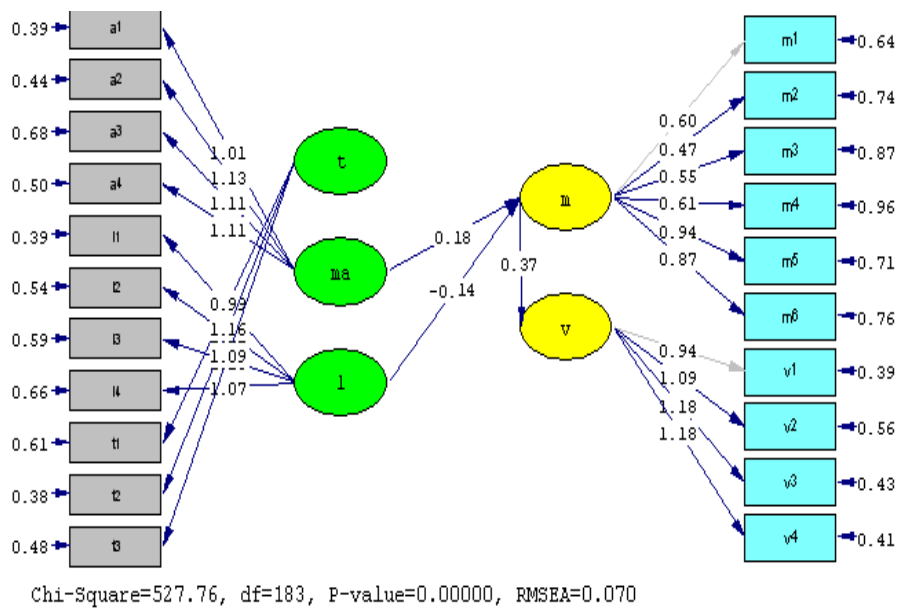
Model 8. *The final structural equation model of research and model*

Chi-Square=255.87, df=181, P-value=0.00021, RMSEA=0.033
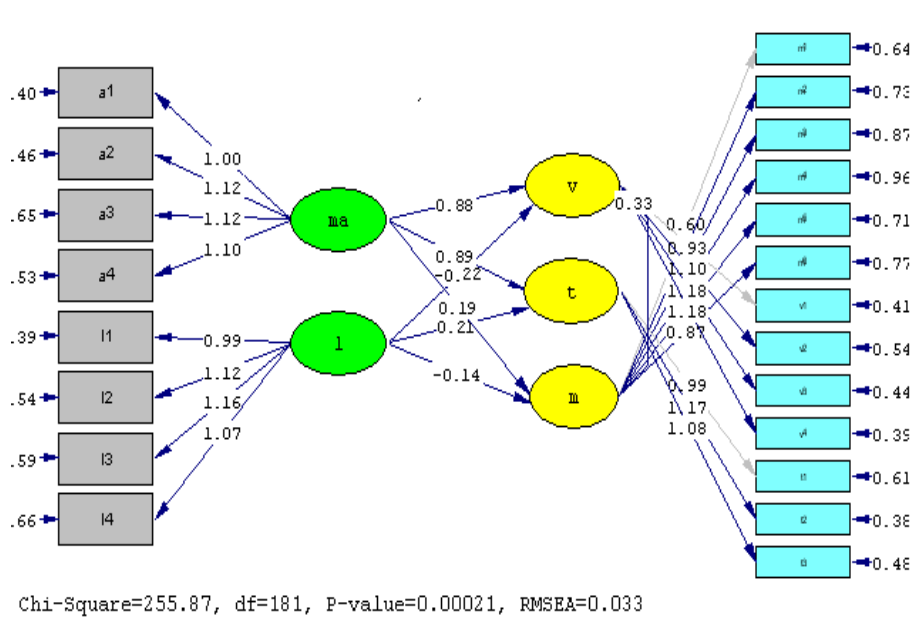
Model 9. *Structural equation model of the study taking into account the direct impact of independent variables on the dependent variable*

Discussion and Conclusion

The aim of this study was to investigate the relationship between purchase values through the green image of store on impulse purchase and customer loyalty. The findings of this study by testing the hypothesis showed that there is no significant positive relationship between of values purchase through green image of store and impulsive purchase. However, there is a significant positive relationship between the values of purchases through green image of store customer loyalty. Given the direct relationship between the values of purchase and impulsive purchases, it can be said that field of marketing positive role store and its feedback on purchase has not been paid much attention.

Since today's customers are not only in search of their intended products and services but want enjoy spending time to this search, so owners are responsible to meet these demands by providing a favorable and attractive environment to increase the number of its loyal customers. On the other hand, all activities should be in harmony with the products and services provided. The more better store image, more customers are attracted to it. on the other hand, according to the relationship between the values of

purchase through the green image of store and customer loyalty, it can be said that today lasting and serving only in one chosen field is not enough. Despite the more complex and more sensitive relations between the seller and the buyer, a trend should be continued that is along with economy and profitability, so besides long lasting organizations need to have positive reputation for sale, employees and customers. Green image in accordance with the rules of limited decision making as an incentive to buy from an organization can act as sign of external information for potential and actual buyers and affect customer loyalty. Today, with increased urban sprawl and shopping malls and promotions in this field, a context is provided so that the values related to the purchase grow and more focus on marketing be created. Since the green image should play a significant role in strengthening values, it is important to note that the store environment significantly affects customer behavior and product evaluation. On the other hand, considering that people in different regions of the world value diverse and unique cultures, it is possible to localize the method presented in this research to cater to the specific needs and

preferences of each region. This opens up new avenues for future research in marketing.

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RESEARCH ARTICLE   **Open Access**

The Effects of Firms' Board Gender Diversity on Their Financial Statement Fraud by the Considering Role of State Ownership

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Abstract
In this paper, the effects of firms' board gender diversity on their financial statements fraud are examined by considering the role of state ownership. Using a logistic regression model, the role of female managers in financial statement fraud is examined for Iranian listed companies from 2013 to 2022. The methodology of this study is a quantitative and ex-post and the sample of this research is related to 153 companies on the TSE. The results of research regression analysis showed that there is a negative and significant relationship between firms' board gender diversity and their financial statements fraud. The results also showed that in the group of non-state firms, there is a negative and significant relationship between firms' board gender diversity and their financial statements fraud, but this relationship is not significant in the group of state-owned firms. According to the research findings, legislators and corporate supervisors should pass laws to encourages corporate gender diversity or requires the minimum number of female directors. Policymakers must also consider the nature of companies' ultimate controllers; because state control over companies has conflicting effects on the regulatory effectiveness of board gender diversity.
Keywords: *Gender diversity, financial statement fraud, State ownership, Woman managers.*

Introduction

Financial statement fraud has received wide attention from the public, the press and regulators. The high-profile scandals, such as Enron, Qwest and Lehman Brothers, triggered a decline in public trust in capital markets (Throckmorton et al., 2015; Keshtkar et al., 2024). Being a large and developing economy in the world, Iran also had a series of financial statement fraud cases during the last decade, resulting in an unparalleled crisis of investors' confidence. Now, financial statement fraud is a major concern for investors in Iran and the Iranian regulators face the severe challenge of addressing this misconduct (Wang et al., 2022). According to US Statement No. 99, fraudulent financial reporting refers to intentional misrepresentation in financial reports to mislead users of financial reports. This issue leads to a situation where financial reporting is not presented in all important aspects in accordance with accepted accounting principles (Zhu & Gao, 2011). Prior studies on fraud focus extensively on the factors contributing to fraud commission or detection. For example, a smaller board is more effective in monitoring managers (Sun et al., 2010). Companies with CEO duality increase the tendency to cheat (Chen et al., 2006). Also, if the company's financial reports are reviewed by major auditing firms, the possibility of fraudulent financial reporting decreases (Lennox & Pittman, 2010). In addition, as the increases of independent directors' networking, the probability of fraud detection decreases (Kuang & Lee, 2017). Since the board of

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directors is responsible for corporate governance and supervision, researchers investigate and study the characteristics of the firms' board of directors; Among these characteristics is the gender diversity of the board of directors, whose effects on the behavior and performance of companies have been studied. Previous literature suggests that companies with female leaders have better corporate performance and higher governance quality (Adams & Ferreira, 2009; Liu et al., 2014; Francis et al., 2015; Low et al., 2015; Adhikari et al., 2019; Liu & Zho, 2024). Based on this, legislators want more women in leadership roles in companies (Liu, 2018; Martinez-Garcia et al., 2024). These suggestions create the need to better understand the benefits of board gender diversity regarding corporate governance and oversight, including dealing with corporate fraud. However, very few studies have focused on the effects of female corporate leaders on financial statement fraud, especially in emerging economies where little information on fraud is publicly available. The findings of this research are expected to provide practical and policy implications for the country and other emerging economies. Because it is very important to study the role and function of the presence of women in the board of directors of companies.

In fact, women play an important role in modern society, labor market and economy (NazemiBigoli et al., 2024). Compared to men, working women usually bear the double burden of running the home and workplace (Wang et al., 2022). Due to cultural norms, this burden is doubly heavy for women (Low et al., 2015). As a result, promotion systems are biased towards men and there is a lack of women in senior management teams and boards of directors. The research field of this article is the Tehran Stock Exchange as the country's capital market, which has been developing rapidly, but due to the speed of development, the presence of women is relatively less. Although Iran's economy is one of the most important economies in the world, the participation of women in the board of directors of companies is not very significant; Many companies either do not have a female board of directors or only have one female board of directors. This issue raises the question whether the presence of women in the board of directors can play a beneficial role in corporate supervision and management. To be more precise, the problem of this research is whether the gender diversity of the board of directors has an effect on the amount of fraud in financial statements.

This paper provides an important contribution to the literature. First, it determines the effects of the presence of women in the board of directors on the amount of fraud in financial statements. Second, the current study reduces the ambiguity of the supervisory role of women leaders in companies. Although the presence of women in top management positions is often considered to increase board independence, monitoring, advisory capacity and resource allocation, empirical evidence is mixed and sometimes contradictory (Zalata et al., 2018). According to the differences between the studies, this paper shows that women in the board of directors have a greater ability to prevent and detect possible frauds. Third, this is the first study that examines the relationship between the gender diversity of the board of directors and fraud in financial statements, taking into account the role of state ownership in Iran; Most of the companies active on Tehran Stock Exchange are characterized by centralized ownership structures, and the controlling shareholders are mostly governmental or quasi-governmental institutions. Finally, this paper contributes to the literature on the leadership role of women on the board of directors. The findings of this research support the gender diversity of the board of directors and show that female directors have a more beneficial role, especially in non-governmental companies.

The study is organized as follows: Section 2 discusses the theoretical basis and its hypotheses. Section 3 presents the research methodology. After that, Section 4 provides

major results for our paper. finally, Section 5 is devoted to concluding the paper and describing suggestions for the study.

Literature Review and Hypotheses Development

Upper echelons theory provides insights into women's leadership. This theory states that organizational results are partially determined by the characteristics of top managers (Hambrick & Mason, 1984). Gender diversity can improve board governance decisions and create a beneficial change in board group dynamics; The first section states that by placing managers with diverse skills that may differ between genders, the board is equipped with a broader skill set to deal with different governance challenges (Robinson & Dechant, 1997). The second part also shows that heterogeneous groups with different demographic characteristics behave differently compared to homogeneous groups. In particular, gender diversity has the potential to change group dynamics by influencing cognitive conflicts and cohesion and causing beneficial changes in group thinking and better decision making (Wahid, 2019).

Agency theory also supports the benefits of women's leadership. The board of directors supervise the performance of the managers and reduces the conflict of interests between the manager and the owner in a company. Female managers are better at monitoring activities (Zeraatgari, 2023; Shafiei et al., 2023). There are two main factors that drive different business behaviors resulting from gender diversity: ethical standards and risk preferences (Croson & Gneezy, 2009). From an ethical point of view, previous research shows that women are more morally sensitive than men and are more likely to speak out against unethical behavior and become internal whistleblowers. The reason for this is that men focus on personal success, while women focus on interpersonal relationships and collective goals (Ho et al., 2015). Studies supporting this view show that women are more sensitive to ethical issues in accounting decisions (Cohen et al., 1998; Firoozi nia et al., 2023). Stronger ethical standards of female leaders are expected to translate into stronger ethical leadership that prohibits profit management (Ho et al., 2015).

Another stream of studies focuses on the effect of gender on risk aversion and shows that female leaders in companies are more risk averse than male managers in financial decisions (Croson & Gneezy, 2009; Hanousek et al., 2019; Sayyari et al., 2023). A risk-averse person is less likely to commit financial fraud (Wang et al., 2022). Women are more conservative and usually adopt strategies that avoid the worst consequences (Byrnes et al., 1999). In general, a company's risk level decreases significantly after appointing a female CEO (Martin et al., 2009). In addition, female managers in companies are ready to receive advice from experts, which leads to a reduction in the risks of violating laws and regulations (Wang et al., 2022). Accordingly, with the presence of women on the board of directors, companies are less likely to underestimate the risks of fraud and lawsuits; Therefore, they engage in activities that are aligned with social responsibility and lead to higher financial reporting quality (Liu, 2018; Wahid, 2019).

A growing number of studies have shown that women are more moral and less involved in crime and litigation than men (Adhikari et al., 2019). Female leaders in companies are generally more conservative in financial reporting (Ho et al., 2015) and when female managers are responsible for overseeing financial reporting policies, they are more sensitive to potential lawsuits and default risks (Francis et al., 2015; Liu & Zho, 2024). In addition, managers are more reliable and compliant with rules and regulations when making financial decisions (Beu et al., 2003). Based on this, the first hypothesis of the research can be stated as follows:

H1: The board gender diversity has negative and significant effects on fraudulent financial reporting.

If a state firm has a gender-balanced board of directors, it brings credibility to the

company and reflects the government's efforts for gender equality (Saeed et al., 2016). Female managers in companies may be less likely to break the rules and report accounting irregularities due to their ethically sensitive and risk-taking characteristics (Cumming et al., 2015). However, the regulatory effects of female leaders in companies may be less obvious for the following reasons (Wang et al., 2022):

First, compared to non-state-owned enterprises, the operating objectives of state-owned enterprises (SOE) are to maximize shareholder wealth as well as bear the burden of policymaking. This time politics may negatively affect firm value (Wu et al., 2012a&b). Female leaders in companies may be reluctant to challenge business decisions that have political considerations.

Second, the regulatory effects of female corporate leaders may be weakened in state-owned firms to account for future political promotion. Successful leaders in state-owned enterprises can be rewarded with a promotion to a prestigious job in the government. However, when fraud is detected, senior managers and boards of SOEs may be more likely to be removed, as news of fraud damages the government's image (Wang et al., 2019). This dismissal means the suicide of the political career of the company's leaders.

Some studies have shown that gender diversity is greater in non-SOEs than in the SOEs (Sun & Zhang, 2021). Since the skills and business backgrounds of women leaders in companies are different, NGOs must operate under the strategic leadership of managers with different backgrounds in order to compete with SOEs in a competitive environment. A market-oriented approach in NGOs enables female managers to play a more active role in monitoring. Some studies have also shown that companies with female board of directors are better able to prevent fraud in financial statements, and this case is more evident in non-SOEs (Wang et al., 2022). Therefore, the second hypothesis of the research is presented as follows:

H2: The board gender diversity has a weaker negative and significant effects on fraudulent financial reporting for state-owned firms compared to non-state firms.

Methods

The nature of the current research is in a way that seeks theory testing and intends to provide evidence for strengthening, confirming or improving the shortcomings of a theoretical framework that has already been tested elsewhere, in a new field or geography. Also, this research is among applied researches in terms of its purpose. In this research, the library method is used to collect data and information. To be more precise, the data of this research is based on the financial statements of all companies active on Tehran Stock Exchange. In this regard, the data of all the active companies whose financial year ended at the end of Esfand and which are not classified as financial and investment companies were used. According to the results of searches and surveys, 153 companies were selected as research samples and the data collected through Rahavard Novin software and the official website of Stock Exchange Organization in the period between 2013 and 2022 were used for analysis. became; It should be noted that according to the method of measuring some variables, the data of the year before the investigated period were also used. Research analyzes were also done using SPSS-24 and Eviews-9 software.

Fraud in financial reporting is the dependent variable of this research. In this article, similar to Khajavi and Ebrahimi (2016) and in accordance with Iran's Auditing Standard No. 240 as "Auditor's responsibility in connection with fraud and error in financial statements", signs indicating the possibility of distortions caused by fraud in financial statements are used as follows:

1) Overstatement of inventory, 2) Overstatement of accounts and receivables, 3) Overstatement of fixed assets, 4) Overstatement of investments, 5) Deficit of reserve for doubtful receivables, 6) Deficit of

depreciation, 7) Overstatement of income, 8) Overstatement of profit, 9) Overstatement retained earnings, 10) understatement of accounts and payables, 11) tax reserve deficit, 12) contingent liabilities, 13) employee severance benefit reserve deficit, 14) understatement of expenses, 15) overdue accounts and payables, 16) stagnant inventory, 17) stagnant assets, 18) going concern problems and 19) errors in applying accounting standards related to measurement, recognition, classification, presentation or disclosure.

If any of these signs are present in the adjustment clauses of the annual audit reports of the companies, its value will be equal to one, indicating the possibility of fraudulent reporting, and otherwise, its value will be zero. It should be noted that the audit report of the companies admitted to the Tehran Stock Exchange can be accessed through the Codal website (comprehensive information system for issuers of the Securities and Exchange Organization). In the following, the k-means clustering method is used to separate the sample companies into fraudulent and non-fraudulent companies. Clustering is the assignment of objects to groups (clusters) in such a way that the objects of one cluster are more similar to each other than the objects of different clusters.

The independent variable of this article is the presence of women in the board of directors. Our measure of board gender diversity is similar to previous studies, it is measured through a dummy variable if there are female managers on the board (Sun & Zhang, 2021; Wang et al., 2022); Thus, if female executives are on the board, this variable takes the number one, otherwise, the number zero.

Also, according to the objectives of the study and the proposed literature, the state ownership (SO) variable plays a role as a moderating variable in this article. A dummy variable was used to measure the state ownership variable; So that if the major shareholder is a company, the government or government-affiliated institutions, the number is one and otherwise, the number is zero. Also, in this study, similar to other studies, some factors affecting the possibility of fraudulent financial reporting have been controlled (Wang et al., 2019). The size of the board of directors (Bsize) (the number of board members) affects the effectiveness of monitoring the quality of financial reporting. Larger audit firms can better prevent fraud and increase the quality of financial reporting (Lennox & Pittman, 2010); Based on this, the size of the auditor (Big_Audit) (it is a dummy variable that takes the number one if the auditor of the company is performed by the audit organization or the audit institutions of class A and zero otherwise) as a variable. control is used. In addition, the independence of the board of directors (Busy Board) (the ratio of non-executive board members to the total board members of the company) has been used to measure intra-organizational monitoring. Also, based on previous literature (Donelson et al., 2017; Wang et al., 2019 & 2022), the variables of market value to book value of equity (MTBV), company size (Size), return on total assets (ROA) and financial leverage ratio (Lev) are also controlled.

Considering that in this paper the dependent variable (fraud in financial statements) is not continuous and has only one of two values zero and one, multivariable logistic regression model has been used to test the research hypotheses. The most important feature of the logistic regression model is that it does not need to establish the assumptions of normality and homogeneity of the covariance matrices. In the logistic regression model, chi-square statistic is used to check the overall significance of the regression model. The goodness of fit of the logistic regression model is also checked using Hosmer and Lemshow tests. Also, regarding the significance test of each of the logistic regression coefficients, the Wald statistic is used, which is a chi-square distribution. Finally, in logistic regression, indicators such as Cox-Snell's R2 and Neglekirk's R2 are used to examine the changes in the dependent variable for the change in the independent variables (Peng et

al., 2002). In this regard, the logistic regression model to test of the H1 is as follows:

$$Fraud_{it} = \alpha_0 + \beta_1 Gender_{i,t} + \beta_2 Bsize_{it} + \beta_3 Big\_Audit_{it} + \beta_4 Busy\ Board_{it} + \beta_5 MTBV_{it} + \beta_6 Size_{it} + \beta_7 ROA_{it} + \beta_8 Lev_{it} + \sum Industry + \sum Year + \varepsilon_{it} \quad (1)$$

where Fraud and Gender are financial statement fraud and board gender diversity measures, as defined above.

The rest of the variables of the model are the control variables, the way of their measurement is explained above. If the $\beta1$ coefficient is significant, we can talk about not rejecting the H1. Similar to previous studies, the subgroup method was used to test the H2 (Wang et al., 2022). In this way, to test this hypothesis, first, the companies are divided into two groups of state and non-state ownership, and the above regression model is implemented in both groups independently. Then, according to the results obtained from the tested patterns in each of the subgroups, it is discussed whether or not to reject the second hypothesis; If the coefficient of the independent variable is significant in both groups to be compared, the Paternoster's test is used to compare the strength of the coefficient of this variable in the two groups (Paternoster et al., 1998).

Results

In this section, the findings obtained from the analysis of the paper are presented. Table 1 shows the descriptive statistics of all variables used. According to the information in this Table, the average variable of fraud in financial statements (Fruad) shows that about half of the studied cases (50.7%) had the possibility of fraudulent financial reporting, which is relatively significant. The amount of statistics related to the variables of board gender diversity (Gender) and state ownership (SO) also indicate that in the studied companies, about 24.7 percent of the cases have a female board of directors and 36.5 percent of them had a state ownership structure. The information related to other features of the board of directors (the size of the board of directors (Bsize) and the board independence (Busy Board)) also show that on average there were usually about 5 members of the board of directors of the companies and in about 60% of they have no executive responsibility in the company. The information related to the control variables of the ratio of market value to the book value of equity (MTBV) and the ratio of return on total assets (ROA) indicate that on average the market value of the studied companies was 2.957 times their book value and they have a profitability of about 19.3% of their total assets. Finally, based on the information related to the financial leverage ratio (Lev) variable, it can be said that more than half of the assets of the studied companies (69.7 percent) are financed from debt.

Table 1.
Descriptive statistics of research variables

Variables	Min	Max	Mean	S.D.
Fraud	0	1	0.507	0.500
Gender	0	1	0.247	0.374
SO	0	1	0.365	0.473
Bsize	3	9	5.423	0.947
Big_Audit	0	1	0.419	0.437
Busy Board	0.111	0.857	0.606	0.244
MTBV	-1.743	9.793	2.957	1.184
Size	10.756	15.236	12.839	1.839
ROA	-0.259	0.583	0.193	0.119
Lev	0.074	1.148	0.697	0.189

In the continuation of this section, the results related to the reliability check of the research variables in order to ensure the non-falsity of the regression model and the

regression findings related to the testing of the hypotheses are presented. The results of the reliability of the research variables using Levin, Lin and Chu, Im, Pesaran and Shin, Dickey Fuller adjusted and Phillips Perron unit root tests are presented in Table No. 2. According to the information in this Table, in all independent, dependent, moderating and control variables, the level of significance in the unit root tests of Levin, Lin and Chu, Im, Sons and Shin, Dickey Fuller adjusted and Phillips Perron is smaller than 0.05. It indicates that the variables are stable.

Table 2.

The results of the reliability test of research variables

Variables	Levin, Lin and Chu test		Im, Pesaran and Shin test		Dickey Fuller adjusted test		Phillips Perron test	
	Amount	Sig.	Amount	Sig.	Amount	Sig.	Amount	Sig.
Fraud	-36.973	0.000	-22.111	0.000	1115.35	0.000	1455.49	0.000
Gender	-37.353	0.000	-17.602	0.000	962.027	0.000	1161.64	0.000
SO	-58.301	0.000	-21.999	0.000	1039.33	0.000	1215.64	0.000
Bsize	-54.062	0.000	-23.652	0.000	1089.75	0.000	1416.45	0.000
Big_Audit	-29.802	0.000	-9.044	0.000	640.506	0.000	673.026	0.000
Busy Board	-59.383	0.000	-18.358	0.000	588.318	0.000	677.438	0.000
MTBV	-43.238	0.000	-22.361	0.000	2550.62	0.000	2573.94	0.000
Size	-30.215	0.000	-17.358	0.000	923.749	0.000	1215.01	0.000
ROA	-362.438	0.000	-23.204	0.000	478.122	0.000	566.279	0.000
Lev	-65.678	0.000	-13.177	0.000	427.538	0.000	502.871	0.000

Table 3 shows the results related to the test of the H1 to investigate the effects of board gender diversity on fraud in financial statements. As the above Table shows, the amount of chi-square statistic and the level of significance related to this statistic indicate the significance of the whole model. The significance level related to Hosmer and Lemshow's statistic indicates the appropriate fit of the model with the actual observations (goodness of model fit). Cox-Snell's R^2 and Neglekirk's R^2 indices in the model are 32.8% and 48.3%, respectively, which indicate the appropriate predictive power of the model; This means that the independent and control variables are able to predict the dependent variable of this research well.

Also, according to the value of the parent statistic and the level of significance listed in Table 3, it can be seen that there is a significant negative relationship between the board gender diversity and fraud in the financial statements. Hence, the H1 is accepted. Also, the results of the control variables show that there is a significant negative relationship between the board size, board independence, the auditor size and the firm size with fraud in financial statements. In addition, the relationship between financial leverage ratio and fraud in financial statements is positive and significant. While there is no significant relationship between the ratio of market value to book value of equity and fraud in financial statements.

Table 3.

Regression results related to the H1

Variables	β	Wald	Sig.
Gender	-0.456	14.836	0.000*
Bsize	-0.361	16/424	0.000*
Big_Audit	-0.197	10.966	0.000*
Busy Board	-0.410	15.007	0.000*
MTBV	-0.087	0.736	0.587
Size	-0.112	14.578	0.000*
ROA	-0.207	11.947	0.000*

Variables	β	Wald	Sig.
Lev	0.121	19.088	0.000*
C	-7.436	16.258	0.000*
Chi- square	Sig.	Hosmer and Lemshow	Sig.
347.528	0.000*	6.472	0.119
R^2- Neglekirk	R^2-Cox-Snell	Year fixed effects	Industry fixed effects
0.483	0.328	Yes	Yes
Note: * indicate statistical significance at the 0.01.			

Tables 4 and 5 show the results related to the test of the H2 to investigate the effects of board gender diversity on fraud in financial statements, taking into account the role of state ownership. In Table 4, the results of the regression model of the research in the group of state ownership are presented. According to the information in this Table, the amount of chi-square statistic and the level of significance related to this statistic indicate the significance of the whole model. The significance level related to Hosmer and Lemshow's statistic indicates the appropriate fit of the model with the actual observations (goodness of model fit). Cox-Snell's R^2 and Neglekirk's R^2 indices in the model are 29.4% and 37.9%, respectively, which indicate the appropriate predictive power of the model; This means that the independent and control variables are able to predict the dependent variable of this research well. Also, according to the value of the parent statistic and the level of significance reported in Table 4, there is no significant relationship between the board gender diversity and fraud in financial statements in the group of state-owned companies. Also, the results of the control variables in the group of state-owned companies show that there is a significant negative relationship between the board size, board independence, auditor size and the firm size with fraud in financial statements. In addition, the relationship between financial leverage ratio and fraud in financial statements is positive and significant. While there is no significant relationship between the ratio of market value to the book value of equity and the ratio of return on total assets with fraud in financial statements.

Table 4.
Regression results related to the H2: SEOs group

Variables	β	Wald	Sig.
Gender	-0.025	0.328	0.846
Bsize	-0.263	11.435	0.000*
Big_Audit	-0.205	8.596	0.000*
Busy Board	-0.359	15.382	0.000*
MTBV	-0.063	0.594	0.647
Size	-0.249	17.048	0.000*
ROA	-0.097	1.864	0.375
Lev	0.407	27.246	0.000*
C	-13.048	14.642	0.000*
Chi- square	Sig.	Hosmer and Lemshow	Sig.
76.847	0.000*	7.958	0.208
R^2- Neglekirk	R^2-Cox-Snell	Year fixed effects	Industry fixed effects
0.379	0.294	Yes	Yes
Note: * indicate statistical significance at the 0.01.			

In Table 5, the results of the regression model for testing the H2 in the group of non-state companies are presented. According to the information in this Table, the amount of chi-square statistic and the level of significance related to this statistic indicate the significance of the whole model. The significance level related to Hosmer and Lemshow's statistic indicates the appropriate fit of the model with the actual observations

(goodness of model fit). The values of Cox-Snell's R^2 and Neglekirk's R^2 indices in the model are 31.8% and 44.7%, respectively, which indicate the appropriate predictive power of the model; This means that the independent and control variables are able to predict the dependent variable of this research well. Also, according to the value of the parent statistic and the level of significance shown in Table 5, it can be seen that there is a significant negative relationship between the board gender diversity and fraud in financial statements in the group of non-state companies. Comparing the results of Tables 4 and 5 shows that the board gender diversity has significant negative effects on fraud in financial statements only in the group of state-owned companies. Therefore, it can be said that the H2 is also accepted. It should be noted that due to the non-significance of the negative coefficient of the board gender diversity variable in the group of state companies, there was no need to compare the coefficient of this variable in two groups of government and non-state companies (Tables 4 and 5) using the Paternoster's test. Also, the results of the control variables show that there is a significant negative relationship between the board size, board independence, auditor size and firm size with fraud in financial statements. In addition, the relationship between financial leverage ratio and fraud in financial statements is positive and significant. While there is no significant relationship between the ratio of market value to book value of equity and fraud in financial statements.

Table 5.
Regression results related to the H2: Non-SOEs group

Variables	B	Wald	Sig.
Gender	-0.508	15.948	0.000*
Bsize	-0.492	12.543	0.000*
Big_Audit	-0.418	8.357	0.000*
Busy Board	-0.296	17.118	0.000*
MTBV	-0.094	0.692	0.326
Size	-0.320	17.504	0.000*
ROA	-0.238	13.947	0.000*
Lev	0.184	14.528	0.000*
C	-3.584	15.738	0.000*
Chi- square	Sig.	Hosmer and Lemshow	Sig.
153.372	0.000*	9.183	0.246
R^2- Neglekirk	R^2-Cox-Snell	Year fixed effects	Industry fixed effects
0.447	0.318	Yes	Yes
Note: * indicate statistical significance at the 0.01.			

Discussion and Conclusion

The topic of gender diversity has gained much popularity over the past decade. Women are more risk averse and ethically sensitive than men. This study examines the relationship between gender diversity and financial statement fraud in Iranian listed companies between 2013 and 2022. In addition, the role of the state ownership structure has also been analyzed. The results show that female managers are associated with a higher ability of fraud detection, reducing firms' propensity to engage in fraud. Hence, gender diversity improves financial reporting quality. This finding is in accordance with the theory of upper echelons, agency theory and research background (Croson & Gneezy, 2009; Liu et al., 2014; Hanousek et al., 2019; Wang et al., 2022). However, among firms with a state-owned background, the monitoring ability of female corporate leaders is significantly reduced. To be more precise, the results of He showed that there is a negative and significant relationship between the board gender diversity and the possibility of fraud in the financial statements in the group of non-SEOs, but this relationship is not

significant in the group of SEOs. This indicates that female managers cannot effectively monitor or detect managers' opportunistic behaviors in the state-owned firms, where political connections between firms and governments are prevalent.

The results of this paper's hypotheses provide important implications for policymakers. First, the findings show that female board members increase the board's monitoring ability and reduce the incidence of financial statement fraud. Therefore, it is important to add women's voices to the management teams of companies, as it reduces the risk of fraud. However, compared to developed countries, the participation rate of women as board members is still low in Iran, and there is a legal weakness in this regard. Based on this, it is suggested that the law-making and supervisory bodies of the companies should encourage and oblige the companies to use the minimum number of female managers by passing laws. Also, Tehran Stock Exchange and Securities Organization can oblige companies to use a certain minimum number of female managers in its corporate governance regulations. Second, based on the results of the second hypothesis of the research, it is suggested that policy makers consider the nature of the final controllers of companies; Because government control in companies has opposite effects on the supervisory effectiveness of the gender diversity of the board of directors. More precisely, reducing government influence and political interference in companies can strengthen the supervisory performance of female board members, and this is an issue that legislators should pay attention to.

This study offers several avenues for future research. First, while female managers can detect fraud more effectively, the channels through which they carry out monitoring activities are not considered. For instance, female managers may become internal whistle-blowers and report fraudulent activities to auditors or regulators (Rothschild & Miethe, 1999). Female managers may utilize meetings with supervisors or internal audit committee members who have expertise in financial reporting to affect other managers' behaviors. It would be interesting to identify the monitoring channels of female corporate leaders for future research. Second, it would be interesting to identify whether there will be different fraud behaviors when female managers actually hold the top positions of listed firms as in power hierarchy plays an overriding role in corporate decision-making.

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RESEARCH ARTICLE   **Open Access**

Designing a Support Management Information Systems Model for penetration strategies of Iranian beverages to international markets and its validation

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Abstract
The aim of the research is to design a model of Support Management Information Systems for penetration strategies of Iranian beverages to international markets and validation it. In this research, a combination of interviews with three-stage coding of grounded theory and questionnaires; therefore, this research is mixed. The statistical population of this research includes experts in the field of marketing international products, and according to the research objective, the sampling in this research is purposeful. The sample size in this research was selected to be 10 people based on the snowball sampling method. The research findings identified 8 factors, including Market characteristics (market analysis and selection of target markets), product characteristics (production and packaging), marketing and branding strategies and advertising, cultural and social factors, market challenges and opportunities, management and organizational processes, distribution and sales network, and competitive pricing. ,. The research results showed that for success and penetration in international markets, Iranian beverage companies need to pay special attention to Market characteristics (market analysis and selection of target markets), product characteristics (production and packaging), marketing and branding strategies and advertising, cultural and social factors, market challenges and opportunities, management and organizational processes, distribution and sales network, and competitive pricing. ,. From competitive analysis and identifying market trends to developing new products and using natural materials, all these factors can help optimize marketing strategies. Furthermore, adapting to different cultures and understanding local needs can play a significant role in the success of marketing strategies. Additionally, the use of new technologies and optimization of managerial processes can improve customer relationship management and increase productivity. Ultimately, analyzing consumer behavior and identifying new opportunities can help identify and exploit market opportunities and lead to the sustainable growth and development of Iranian companies in international markets.
Keywords: *Marketing, Management Information System, Marketing Strategy, Information System, Beverages*

Introduction

Today, information is considered the most valuable asset of any organization and should be regarded as an essential commodity, akin to electricity, without which many businesses cannot operate smoothly. The development of information systems is like a double-edged sword that, on one hand, brings numerous benefits to humanity and, on the other hand,

due to information security issues, can cause irreparable damages (Shafiei Nikabadi et al., 2019).

The main issue of the article is that many manufacturing companies face several challenges on the way to enter international markets (Pinho and Prange 2016). These challenges include insufficient knowledge of the needs and tastes of foreign consumers,

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(2020), lack of access to market information quickly and accurately, and lack of appropriate Niittymies & Pajunen strategies to penetrate these markets (Martin et al. 2022). These problems arise due to the lack of effective use of management information systems to analyze data, predict trends and support strategic decisions (Vissak et al. 2020).

This issue becomes more critical especially in situations where international markets are changing at a high speed and the competition among companies to gain a larger share of these markets is increasing day by day (Merkman et al. 2019). In such an environment, not having access to accurate and up-to-date information, and not having proper tools to analyze this information, can lead to making wrong decisions and losing valuable business opportunities (Ju et al. 2018). On the other hand, management information systems as a powerful tool can help companies penetrate international markets more effectively by accurately analyzing data, identifying opportunities and threats, and optimizing decision-making processes (Martin et al. 2022). But so far, there has not been a comprehensive and practical model specifically designed for the Iranian beverage industry. With the aim of filling this gap, this article has designed and validated a model that can solve this problem and help Iranian companies to succeed in global markets. Therefore, the main issue of this article is to design a model that can solve these challenges through management information systems and help Iranian beverage companies to penetrate international markets.

In today's world, management information systems (MIS) play a crucial role in advancing inbound marketing strategies for companies in the beverage industry, especially in international markets where intense competition and cultural and economic complexities exist. MIS, by providing advanced tools for data collection, analysis, and management, helps companies better understand customer needs and behaviors and optimize their marketing strategies. These systems, by providing accurate and timely information, enable companies to design and implement targeted marketing campaigns that can have the most impact on attracting and retaining customers. The importance and necessity of this research lies in providing a comprehensive and practical model to support the penetration strategies of Iranian beverages to international markets using management information systems. In today's world, where the competition in global markets is becoming more complex and intense, Iranian companies need innovative tools and approaches to increase their share in these markets. Focusing on identifying and explaining the key success factors in international marketing, this research has designed and validated a model that can lead to improving strategic decisions, increasing operational efficiency, and improving the competitiveness of Iranian companies in global markets. In addition, a deep understanding of the needs and cultural differences of the target markets and the use of new technologies in information management are among the factors that are considered in this research and can help to optimize marketing strategies and achieve sustainable success in the international arena. So his paper examines how MIS can support inbound marketing strategies for beverages at the international level and analyzes its impacts on the success and growth of companies. Therefore, the results of this research can help Iranian beverage companies improve their marketing strategies and perform more competitively in international markets using advanced MIS. Furthermore, this model can be used as a blueprint for other industries and contribute to the development of knowledge in MIS and international marketing. By utilizing this model, companies can exploit global market opportunities and achieve sustainable growth and development.

In the end, theoretical synergy is mentioned regarding this research. In this regard, it can be said that innovation has occurred in the design of the model in such a

way that a management information systems support model has been designed to support the penetration strategies of Iranian beverages in international markets. This model is specially designed for the beverage industry and in line with the specific needs of this sector, which has not been addressed in previous researches. On the other hand, this research leads to the strengthening of international influence strategies. In fact, by using this model, Iranian beverage companies can implement strategies to penetrate international markets in a more optimal way. Your paper shows how management information systems can help to more accurately analyze markets, anticipate consumer needs, and improve the decision-making process. It is worth mentioning that the model validation section shows how this model can be efficient in practice and thus help decision makers in the Iranian beverage industry to use their resources and opportunities more effectively. This stage of the research adds value to the practical and practical results of the research. In the end, it can be concluded that our research fills an important gap in the existing literature, because so far it has not been addressed comprehensively and with a focus on management information systems to support the penetration of Iranian beverages into international markets. This article specifically responds to the needs of Iranian beverage companies in the fields of strategy, management and information technology and helps to develop theories related to management information systems and their application in formulating and implementing international strategies. This research can be used as a reference for future studies in similar fields.

These cases indicate the contribution of our paper in expanding scientific knowledge and improving practical applications in the fields of management information systems and international marketing strategies.

Theoretical Foundations
Information Systems

Information systems are a set of interconnected elements designed to collect, store, process, and distribute information to support decision-making, coordination, and control in an organization. These systems include hardware, software, data, people, and procedures. The main goal of information systems is to improve the efficiency and effectiveness of organizational processes (Teplická, 2019). Hardware: The hardware of information systems includes computers, servers, storage devices, networks, and communication equipment used to collect, process, and store information. These devices must be up-to-date and have high capacity to process large volumes of data and ensure a quick response to requests (Pervan and Dropulic, 2019).

Software: The software of information systems includes applications and programs used to manage data and perform various tasks. These software can include database management systems, business applications, data analysis tools, and content management systems. Custom software may also be designed and developed to meet specific organizational needs (Jayawickrama et al., 2019).

Data: Data is the heart of information systems. This data can include financial information, customer information, product information, and operational information. Data should be stored in a structured and orderly manner to facilitate quick and accurate retrieval and analysis. Data management includes processes such as data collection, cleaning, validation, and storage (Saydasheva and Sharafutdinova, 2018).

People: People play a very important role in information systems. These people include end users, system managers, data analysts, software developers, and IT managers. Each group of people has specific roles and responsibilities that contribute to the proper and efficient functioning of the system. Training and empowering users is also crucial so that they can make the best use of the system.

Procedures: Procedures and processes in information systems include instructions,

standards, and workflows used to collect, process, and distribute information. These procedures should be designed to ensure the efficiency and security of the system. Security standards, privacy policies, and data backup methods are important aspects in this area (Harkare et al., 2023).

The Strategic Role of Information Systems

Information systems face numerous challenges and opportunities. Challenges include security issues, privacy protection, change management, and high costs. On the other hand, opportunities include improving operational efficiency, enhancing decision-making ability, improving customer service, and creating business innovation. Therefore, in today's business world, information systems play a strategic role. These systems help organizations gain a competitive advantage, increase productivity, and respond quickly to dynamic and complex markets. The use of modern technologies such as artificial intelligence, the Internet of Things (IoT), and blockchain can also improve the performance and efficiency of information systems. As a result, information systems are essential tools for managing and growing organizations. By correctly utilizing these systems, organizations can achieve their goals and attain long-term success in complex and dynamic environments (Jaiswal et al., 2020).

Management Information Systems

Management information systems (MIS) are an integrated set of information technologies, processes, and human resources aimed at collecting, processing, storing, and distributing information to support managerial decision-making, coordination, and control within organizations (Aarti et al., 2023). In these systems, information is collected from various organizational sources such as production, finance, marketing, human resources, and supply chain, and processed and analyzed using advanced software and hardware to be presented in the form of reports and managerial dashboards. These processes include collecting raw data,

processing it into useful information, storing it in databases, and distributing it to end users (Lajsic, 2019). MIS, by providing accurate and timely information, helps managers make informed decisions and effectively implement organizational strategies. These systems can automate processes, increase productivity, and enhance internal and external communications, thereby improving coordination among different parts of the organization. For example, a financial MIS can help managers in forecasting revenues and expenses and in budget planning by analyzing financial data (aiswal and Aryan, 2022). Similarly, human resource MIS can manage employee-related information, performance, training, and development, and assist human resource managers in strategic decision-making. Other key components of MIS include communication networks that transfer information between different parts of the organization. These networks can include the internet, intranet, and extranet. Information security is also a critical aspect of MIS, requiring security measures such as data encryption, the use of firewalls, and intrusion detection systems (Demečko, 2019). Challenges facing MIS include technological complexity, resistance to organizational changes, high implementation and maintenance costs, and security issues. However, with technological advancements such as artificial intelligence, IoT, and big data analytics, the future of MIS is promising, moving towards greater intelligence and empowerment of managers and employees. Given that MIS can significantly impact organizational performance, successful implementation requires careful planning, user training, and change management. Overall, MIS, by creating an integrated platform for collecting, processing, and distributing information, plays a vital role in improving managerial decision-making, increasing productivity, enhancing communication and coordination, and helping organizations achieve their strategic and operational goals (Sarkar and Chung, 2019).

The Importance and Role of Management Information Systems in Organizations

The importance and role of management information systems (MIS) in organizations are extensive and crucial. These systems, by providing accurate and timely information, help managers make better decisions and analyze past, present, and future predictions. By automating work processes and reducing the time spent collecting and processing information, MIS can significantly increase organizational productivity (Vial, 2019). Additionally, by providing a platform for internal and external communications, they help improve communications and coordination between different parts of the organization. These systems allow managers to monitor organizational performance and use analytical tools to identify and solve problems. Furthermore, MIS helps managers set organizational strategies and goals and find optimal methods to achieve them (Arslan and Cruz, 2022). It should be noted that MIS, by integrating and analyzing data, plays a key role in optimizing organizational performance. These systems, by providing comprehensive managerial dashboards and reports, give managers the necessary information to accurately examine market trends, financial and operational performance, and customer needs. Another important advantage of MIS is facilitating planning and forecasting. By using predictive algorithms and analytical models, managers can forecast future trends and prepare for environmental and competitive changes (Kang and Cheung, 2022). In terms of control and monitoring, MIS provides monitoring and control tools that allow managers to continuously track the performance of various organizational units and prevent potential deviations. These systems, by creating transparency in performance and providing up-to-date information, help improve decision-making processes and increase intra-organizational trust (Singh et al., 2019). Additionally, MIS plays a significant role in promoting innovation and continuous improvement. By analyzing data and customer feedback, organizations can identify market needs and expectations and design and offer new products and services. These systems, by supporting research and development processes, help organizations remain innovative in competitive markets and achieve competitive advantages (Puccetti et al., 2023). Finally, it should be mentioned that MIS, by supporting organizational strategies and coordinating between different units, helps improve organizational synergy and efficiency. These systems, by providing strategic information and facilitating the implementation of plans, help organizations achieve their long-term goals and achieve sustainable success in complex and dynamic environments. In summary, MIS are critical tools for improving decision-making, increasing productivity, enhancing communication, controlling and monitoring, and supporting organizational strategies, playing a significant role in the success and sustainable development of organizations (Naser et al., 2019).

Marketing Strategy

A marketing strategy is a set of plans, decisions, and actions that organizations design and implement to achieve their marketing goals. This strategy includes market analysis, identifying target customers, determining competitive advantages, and developing diverse marketing programs. The main goal of a marketing strategy is to create value for customers, thereby increasing market share, improving customer relationships, and enhancing organizational profitability. Initially, the organization must thoroughly analyze the market and external environment to identify opportunities and threats. Then, based on competitive advantages and internal resources, target market segments are selected, and distinct strategies are designed for each segment. These strategies may include pricing, distribution, promotions, and product development. Finally, by continuously monitoring and evaluating the performance of implemented strategies, the organization can adapt and improve these strategies to achieve its marketing goals and succeed in a

competitive environment (Sintani et al., 2023). To achieve a successful marketing strategy, organizations must consider various factors. One of the most important factors is a precise understanding of customers' needs and wants. This understanding can be obtained through market research, surveys, and customer data analysis. With this information, organizations can design their products and services to best meet customer needs (Alsukaini et al., 2023). It is worth mentioning that an effective marketing strategy also requires selecting appropriate channels for communicating with customers. These channels can include social media, online advertising, content marketing, email marketing, and other communication methods. Choosing the right channels helps organizations effectively convey their marketing messages to target audiences and engage more with them (Feld and Hathaway, 2020). Moreover, appropriate pricing is a key component of the marketing strategy. Prices should be set in a way that reflects the value of the product while also being attractive to customers. Pricing strategies may include discounts, special offers, and loyalty programs that can encourage customers to purchase and return (Feller et al., 2021). Additionally, the distribution of products is another critical element of the marketing strategy. Organizations must ensure that their products are delivered to customers on time and in good quality. This can be achieved through selecting suitable distribution partners, managing the supply chain, and optimizing logistics processes. Promotions and advertising also play an important role in the marketing strategy. Through targeted advertising campaigns, organizations can increase brand awareness, highlight the unique features of their products, and encourage customers to buy. Advertising tools can include television, radio, print, and digital advertisements (Li et al., 2021).

It is important to note that a marketing strategy must be flexible and adaptable. Markets and customer behaviors change rapidly, and organizations must be able to respond to these changes. This requires continuous monitoring of marketing performance and evaluating the results. Using data and feedback, organizations can improve their strategies and get closer to their long-term goals. In fact, the marketing strategy should be aligned with the overall strategy of the organization. This alignment helps the organization make the best use of its resources and maximize the effectiveness of marketing efforts. With a comprehensive and effective marketing strategy, organizations can lead in competitive markets, increase customer satisfaction, and achieve sustainable success (Theodosiou & Leonidou, 2003).

Research Methodology

In this research, a combination of interviews with three-stage coding and a questionnaire was used to Designing a Support Management Information Systems Model for penetration strategies of Iranian beverages to international markets and its validation; thus, this research is mixed-methods. Therefore, depending on the type of data and conditions, both qualitative and quantitative approaches were used for the study. Initially, through the use of qualitative data obtained during exploratory research, including exploratory literature review and conducting exploratory (semi-structured) interviews where interview questions are predetermined, and the same questions are asked of all respondents, allowing them to freely express their views on the study subject. Then, in the course of the present study, experts' opinions on the management of information systems and marketing strategies were revealed using the survey method. Given the mentioned points, this research is exploratory. The analysis method of this research is mixed (quantitative and qualitative). The statistical population of this research includes experts in the field of international product marketing, and the sampling method in this research is purposeful. The sample size in this study was selected using the snowball sampling method. In this method, future sample members are selected through previous sample members, and the sample grows like

a snowball. For example, in qualitative interview research, individuals are asked if they recommend someone else for an interview, thus expanding the sample. If this sampling is done using social media, it is called virtual snowball sampling. The primary application of the snowball method is studying hidden populations. This sample starts with an initial number of individuals, who are then asked to recommend others they think are suitable for the research program. It is possible that research groups exist from which sampling can be done. Finally, by studying the personality and lives of individuals, we must ensure a wide range of people are present in our sample. This research was conducted using the grounded theory method.

Research Findings

Given the qualitative nature of the research, a grounded theory approach was used for analysis, leading to identifying the penetration strategies of Iranian drinks in the international market. The stages of grounded theory include three main stages: open coding, axial coding, and selective coding. In the first stage, interview themes are extracted as codes. In the second stage, or axial coding, themes are placed under components, and in the third stage, components are categorized into larger dimensions, forming the final model. The next stage is open coding. As shown in Table 1, all three stages are illustrated.

Table 10

Three-Stage Coding Through Grounded Theory

Open Coding	Axial Coding	Selective Coding	
Competitor Analysis, SWOT Analysis, Market Research, Pricing, Advertising Strategies, Target Customer Identification, Market Trend Analysis, Customer Needs Assessment, Consumer Preference Research, Competitor Identification, Marketing Opportunity Identification, Market Demand Analysis, Market Threat Assessment, Competitor Strengths and Weaknesses Analysis, Consumer Behavior Study, Economic Conditions Assessment, Environmental Opportunities and Threats Analysis, Pricing Strategy Determination, Target Market Research, Competitor Identification, Market Changes Analysis, Regional Competition Analysis, Global Trend Analysis, Competitor Analysis, New Market Identification, Customer Needs Assessment Competition in the European Market - Consumer Preferences in the Asian Market - Impact of Social Media Platforms in the Latin American Market	Competitor analysis, customer needs, market trends, pricing, target customer, advertising competition analysis Identifying market trends Consumer preferences	Market characteristics (market analysis and selection of target markets)	1
Quality Analysis, Packaging Evaluation, Innovation Review, Product Diversity Analysis, Technical Specifications, Standards Review, Research and Development, Quality of Raw Materials, Technical Capabilities Assessment, Standards Evaluation, Durability and Resistance Review, Product Testing and Evaluation, Consumer Feedback Analysis, Product Feature Assessment, Performance Analysis, Appearance Specifications Review, Technical Needs Assessment, Comparative Evaluation, New Capabilities Research, Competitive Features Review, Innovation Review, Packaging Evaluation, Quality Analysis, Product Quality Evaluation, Competitive Features Review, Product Quality Assessment,	Compliance with international quality and packaging standards. Designing attractive and modern packaging that is liked by foreign consumers. Providing diverse products according to different tastes of the market International standards, attractive packaging, product variety,Product quality, innovation,	Product characteristics (production and packaging)	2

Open Coding	Axial Coding	Selective Coding	
Technical Needs Review, Competitive Features Analysis Use of Natural Sweeteners Emphasis on Health Benefits Combination of Iranian Flavors in the Asian Market	packaging, product variety, technical specifications, standard compliance New product development Using natural materials Optimizing flavors		
Creating a strong and reliable brand in target markets. Using social networks and digital advertising to introduce products. Using local media in target markets to promote products Digital advertising, content marketing, public relations, brand building, outdoor advertising, sales strategies, advertising campaigns, advertising effectiveness analysis, brand analysis, marketing tactics review, content strategy determination, PR impact evaluation, social media advertising, campaign analysis, branding impact assessment, outdoor advertising effectiveness analysis, sales method review, online advertising impact evaluation, advertising strategy analysis, consumer behavior analysis, advertising effectiveness assessment, consumer behavior analysis, sales tactics review, advertising strategy analysis, online advertising impact assessment Designing social media campaigns for the market Tailoring messages for specific audiences Using targeted advertising	Strong branding Digital advertising Local advertising Online advertising, content strategies, public relations, branding, outdoor advertising, sales strategies Using MIS data Personalizing campaigns Using social media	Marketing and branding strategies and advertising	3
Cultural impact, occasions, shopping habits, consumer preferences, social networks, media influence, cultural analysis, local occasion study, shopping habit review, consumer preference analysis, media influence on consumer behavior, cultural impact assessment, social network role review, cultural occasion analysis, social impacts, media role review, cultural consumer behavior analysis, cultural changes review, social impact assessment, media role in advertising review, social impact analysis, culture's role in marketing review, media influence analysis, social networks role assessment, occasion impact review Attention to cultural differences in branding strategy Development of halal products for Muslim markets Emphasis on cultural identity in flavors	Cultural impact, occasions, shopping habits, consumer preferences, social networks, media influence Adapting to different cultures Identifying local needs Understanding cultural differences	Cultural and social factors	4
Competitive analysis, growth opportunities, legal barriers, environmental threats, strengths and weaknesses, SWOT analysis, competitor review, identification of growth opportunities, legal review, environmental threat assessment, strength analysis, weakness review, opportunity analysis, threat review, legal assessment, competitive situation analysis, international law review, environmental threat evaluation, regional competition analysis, new opportunity analysis, organizational strength assessment, market weakness review, opportunity and threat assessment, market situation analysis, competitor weakness evaluation, environmental threat	Competition, growth opportunities, legal barriers, environmental threats, strengths and weaknesses, SWOT analysis Facing competition Identifying new opportunities Analyzing consumer behavior	Market challenges and opportunities	5

Open Coding	Axial Coding	Selective Coding	
analysis, new law assessment, growth opportunity review, competitor strength analysis Utilizing MIS data for market opportunity identification Developing new products to meet consumer needs Competing with international competitors			
Human resource management, information systems, work processes, leadership, change management, organizational communication, human resource analysis, information systems review, work process analysis, leadership style assessment, change management review, organizational communication analysis, information system evaluation, internal process analysis, leadership style review, organizational change analysis, resource management system evaluation, information systems review, process efficiency analysis, change impact assessment, communication system review, managerial style analysis, management information system evaluation, communication efficiency review, leadership style analysis, change management system assessment, work process review, management impact evaluation, leadership role analysis Automating marketing tasks Using artificial intelligence algorithms Creating customer loyalty programs	Human resource management, information systems, work processes, leadership, change management, organizational communication Optimizing marketing processes Using new technologies Improving customer relationship management	Managerial and organizational processes	6
Creating effective and extensive distribution networks in target markets. Collaborate with local distributors and vendors to increase product availability.	Distribution network development Cooperation with local distributors	Distribution and sales network	7
Checking competitors' prices and setting competitive prices for products Provide discounts and special offers to attract new customers	Pricing analysis Discounts and special offers	Competitive pricing	8

In the end, after determining the components of the grounded theory paradigm model for our research topic, the initial model developed in the qualitative section is presented as follows:
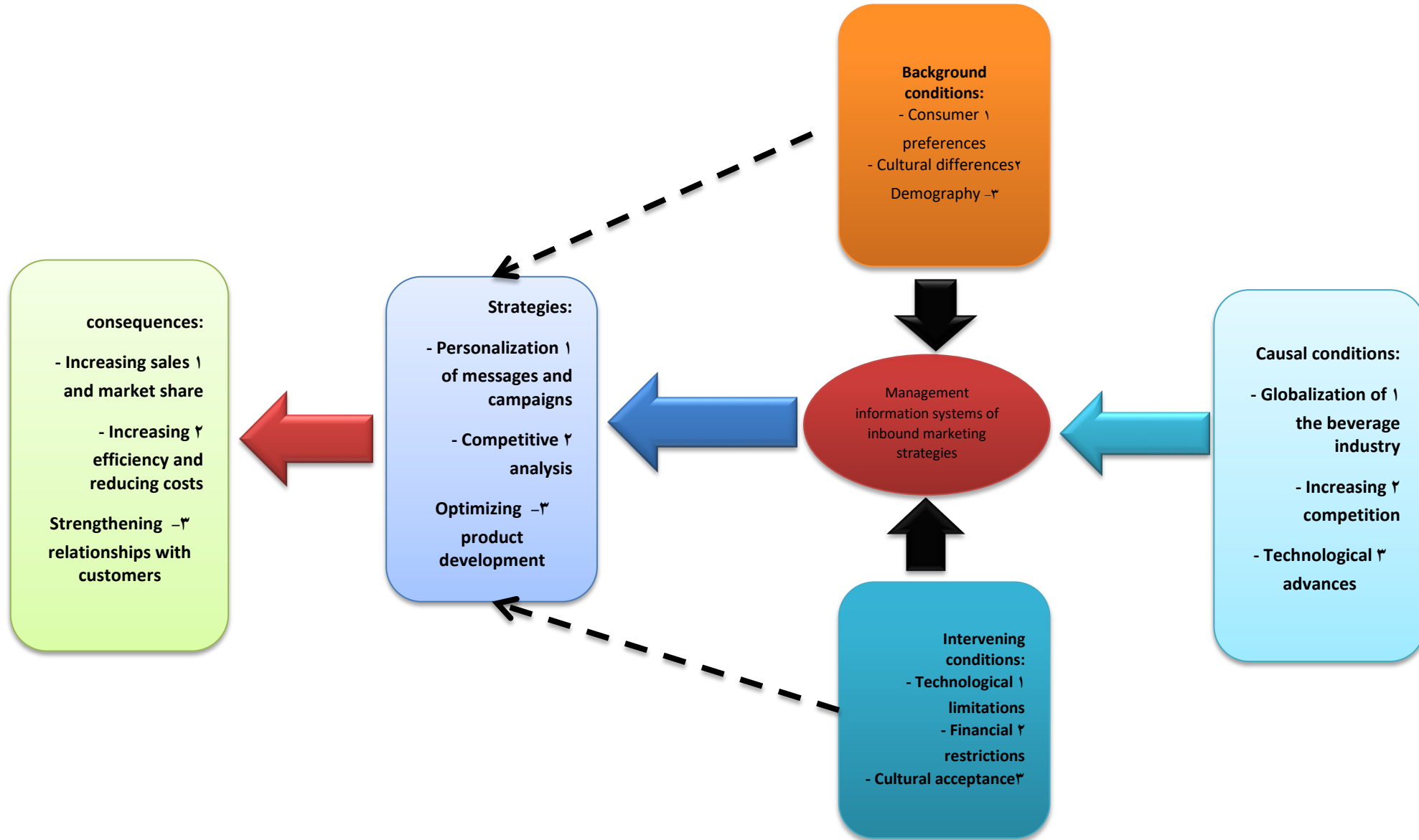
Figure 1 - The initial model of research based on grounded theory

Before entering the stage of testing the hypotheses and the conceptual model of the research, it is necessary to ensure the accuracy of the measurement models of exogenous and endogenous variables. This work has been done through confirmatory factor analysis. In order to analyze the structure of the questionnaire and discover the factors that make up each structure, factor loadings have been used. The results of factor loadings of research variables are shown in Figure 2.
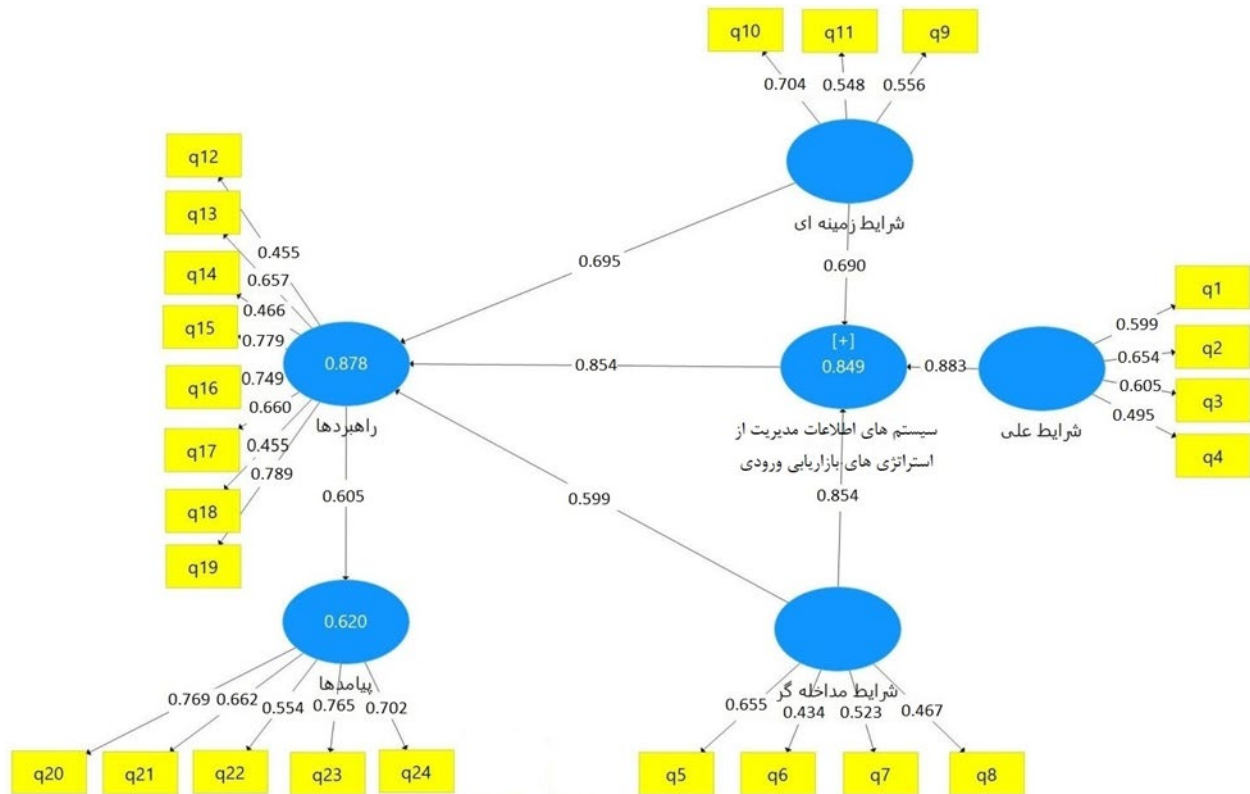
Figure 2. *Final standardized model of factor loading*

At this stage, it was observed that all factor loading values of research questions are more than 0.40. Therefore, the alignment of questionnaire questions to measure concepts can be shown as valid in this stage. In fact, the above results show that what the researchers intended to measure with the questionnaire questions has been achieved by this tool. Therefore, the relationships between constructs or hidden variables can be cited. An index with a higher factor load is more important than other indices. The measurement model is a part of the overall model that includes a variable along with questions related to that variable. Therefore, to analyze the general model of this research, we need to examine the existing measurement models. Three criteria of reliability, convergent validity and divergent validity are used to check the performance of measurement models.

Table 2.
Factor loading coefficients, Cronbach's alpha-composite reliability, convergent validity

Cronbach's alpha coefficients	(CR)	(AVE)	Explicit variables
α ≥ 0/7	CR ≥ 0/7	AVE ≥ 0/4	
۰/۸۳۰	۰/۷۹۵	۰/۶۶۹	Management information systems of inbound marketing strategies

Cronbach's alpha coefficients	(CR)	(AVE)	Explicit variables
α ≥ 0/7	CR ≥ 0/7	AVE ≥ 0/4	
۰/۷۳۲	۰/۸۲۳	۰/۵۵۶	Strategies
۰/۹۲۰	۰/۷۲۴	۰/۴۵۰	Background conditions
۰/۹۴۴	۰/۷۷۷	۰/۷۲۰	Causal conditions
۰/۷۳۵	۰/۷۳۲	۰/۷۳۵	Intervening conditions
۰/۸۶۹	۰/۷۹۲	۰/۴۹۲	consequences

Investigating divergent validity is through the degree of relationship between the structure and its indicators, comparing the relationship of that structure with other structures; In such a way that the acceptable divergent validity of a model indicates that a construct has more interaction with its indicators than with other constructs. Divergent validity is acceptable when the AVE for each construct is greater than the shared variance of that construct and other constructs (the square of the correlation coefficients between constructs) in the model. This is checked by a matrix, the cells of this matrix contain the values of the correlation coefficients between the constructs and the square root of the AVE values of each construct. An example is shown in Table 22-4. Then we replace the values on the main diameter of the matrix with the square root of the variance values described in AVE and finally table 3 is presented.

Table 3.
Fornell-Larker table after placing the square root values of AVE

	Management information systems of inbound marketing strategies	Strategies	Background conditions	Causal conditions	Intervening conditions	consequences
Management information systems of inbound marketing strategies	۰/۶۷۵					
Strategies	۰/۶۲۵	۰/۸۴۴				
Background conditions	۰/۶۰۲	۰/۵۷۳	۰/۸۲۱			
Causal conditions	۰/۵۴۴	۰/۶۸۵	۰/۶۱۵	۰/۸۳۴		
Intervening conditions	۰/۵۰۳	۰/۶۲۴	۰/۵۹۳	۰/۷۰۳	۰/۸۳۰	
consequences	۰/۵۰۱	۰/۷۸۷	۰/۵۹۲	۰/۷۵۹	۰/۶۰۳	۰/۸۵۶

As can be seen in the table above, the values on the main diameter of the matrix are greater than all the values in the corresponding row and column. Now, in order to structurally fit the model, we act as follows. In the following, we apply the three criteria "R2", "Q2" and "F2" to fit the structure of the research model. Table 4 shows the values of these three criteria for the dimensions of the research model:

Table 4.
Values of three criteria for fitting the research model

Q^2	R^2	Indicator		
Weak 0.02	Weak 0.19	Threshold value	Dimensions	row
Average 0.15	Average 0.33			

0.35 strong	Strong 0.67			
٠/٢٢١	٠/٨۴٩	value	Management information systems	1
strong	strong	Result (strong/moderate/weak)		
٠/٣٠٧	٠/٨٧۶	value	Strategies	2
strong	strong	Result (strong/moderate/weak)		
٠/١٩٢	٠/۶١٨	value	consequences	3
moderate	strong	Result (strong/moderate/weak)		

In addition to these two criteria, the "F2" criterion also determines the intensity of the relationship between the constructs of the model. The values of 0.02, 0.15 and 0.35 indicate the intensity of weak, medium and strong relationship, respectively. The value of this criterion can be seen in Table 5:

Table 5.
Values of F2 criterion for fitting the research model

	Management information systems	Strategies	consequences
Management information systems of inbound marketing strategies		٣/٣۴٣ strong	
Strategies			١/۵٩ strong
Background conditions	٠/۴٧۵ strong	٠/٣۵٠ strong	
Causal conditions	٠/٣۶٧ strong		
Intervening conditions	٠/٧٨٨ strong	٠/٢۴٩ strong	

Finally, using the "goodness of fit" criterion, we evaluate the overall research model. We use equation 1 to calculate GoF. Three values of 0.01, 0.25 and 0.36 are respectively weak, medium and strong values for GoF. This criterion is the geometric mean of the average coefficient of multiple determination in the average of commonality. The geometric mean is R2 and the common mean. In the following table, the results related to the test of relationships between research variables are presented according to Figure 2:

Table 6.
Test of relationships between research variables

Results	P values (significance level)	T	(STDEV)	Path coefficient	Relationships
Confirmation of relationship	٠/٠٠٠	۴/٨٨٠	٠/٠١١	٠/٨۵۴	Management information systems <-Strategies
Confirmation of relationship	٠/٠٠٠	٣/۵٩٨	٠/٠١۶	٠/۶٠۵	Strategies <-consequences
Confirmation of relationship	٠/٠٠٠	٧/۶۴۴	٠/٠٣٧	٠/۶٩٠	Background conditions <-Management information systems
Confirmation of relationship	٠/٠٠٠	۵/١٣٧	٠/٠٣٠	٠/۶٩۵	Background conditions <-Strategies

Results	P values (significance level)	T	(STDEV)	Path coefficient	Relationships
Confirmation of relationship	۰/۰۰۰	۷/۷۸۹	۰/۰۳۲	۰/۸۸۳	*Causal conditions <- Management information systems*
Confirmation of relationship	۰/۰۰۰	۴/۶۵۵	۰/۰۲۵	۰/۸۵۴	Intervening conditions <- Management information systems
Confirmation of relationship	۰/۰۰۰	۳/۳۳۷	۰/۰۳۲	۰/۵۹۹	Intervening conditions <- Strategies

Discussion

In the era of globalization and fierce competition in international markets, Iran's beverage industries need efficient and innovative marketing strategies to increase their share of global markets. The design and implementation of management information systems can play a role as a powerful tool in this direction. The research findings of 8 factors that include market characteristics (market analysis and selection of target markets), product characteristics (production and packaging), marketing and branding strategies and advertising, cultural and social factors, market challenges and opportunities, managerial and organizational processes, Distribution and sales network, and competitive pricing. And the coefficient of the factorial path is more than 0.4, which shows that the paths and assumptions of our research have been confirmed. This research was conducted with the aim of designing a model for management information systems that supported the marketing strategies of Iranian beverages at the international level and its validation. Using grounded theory as a research method helps to identify and explain the key success factors in this field. This model can lead to the improvement of marketing decisions, increasing operational efficiency and improving the competitiveness of Iranian companies in global markets. In the complex and dynamic environment, management information systems provide managers with valuable information that can help optimize marketing strategies and decisions by aggregating, processing, and analyzing marketing-related data. By providing analytical reports and management dashboards, these systems

allow organizations to react quickly and take appropriate actions to attract and retain international customers. In this research, the needs and challenges in the marketing of Iranian beverages at the international level are first investigated. Then, using the grounded theory method, a comprehensive model for management information systems was designed that can specifically support these marketing strategies. Validation of the proposed model was another part of this research. For this purpose, the model was tested and evaluated using real data and through valid scientific methods.

Based on the analysis done and the coding done on the interviews, it can be concluded that in order to be successful in the international markets, Iranian companies in the field of beverages must pay attention to market characteristics, product characteristics, marketing strategies, cultural and social factors, market challenges and opportunities, and Management and organizational processes should be given special attention. From analyzing competition and identifying market trends to developing new products and using natural ingredients, all these factors can help optimize marketing strategies. In addition, adapting to different cultures and understanding local needs can play an important role in the success of marketing strategies. Also, using new technologies and optimizing management processes can help improve customer relationship management and increase productivity. Finally, analysis of consumer behavior and identification of new opportunities can help to identify and exploit market opportunities and cause sustainable

growth and development of Iranian companies in international markets.

It is worth mentioning that to succeed in international markets, Iranian companies must pay attention to some other key factors. First, it is critical to accurately identify consumer preferences in each target market. This includes analyzing the buying behavior, tastes, and needs of different consumers in different geographic regions. With this information in mind, companies can tailor their products to match local needs and be most attractive to consumers. Second, marketing strategies must be designed strictly based on accurate data and information. The use of management information systems allows companies to collect and analyze market data and make intelligent decisions based on them. This includes identifying market trends, analyzing competitors, and predicting market changes. The third important factor is the emphasis on the use of new technologies in management and organizational processes. For example, the use of AI algorithms can help automate marketing tasks, improve ad targeting, and optimize customer experiences. These technologies can also play an important role in identifying new opportunities and accurately analyzing consumer behavior.

In addition to these cases, companies should also pay special attention to cultural and social factors. Adapting to different cultures and understanding cultural differences can help design successful branding strategies and develop appropriate products for different markets. For example, paying attention to the specific needs of Muslim markets, such as the production of halal products, can open up new markets for companies. Finally, facing challenges and taking advantage of market opportunities requires a dynamic and flexible approach. Companies must be able to quickly react to market changes and adjust their strategies based on new conditions. This requires having strong management teams and using efficient management processes. Therefore, according to the analysis, it can be concluded that the combination of smart marketing

strategies, use of new technologies, deep understanding of consumer needs and preferences, and attention to cultural and social factors can lead to sustainable success of Iranian companies in international markets. This comprehensive and comprehensive approach allows companies to stand in front of competitors and take a greater share of global markets. Considering the importance and high potential of international markets for the penetration of Iranian beverages, comprehensive and intelligent strategies should be used to achieve this goal effectively and sustainably. Accurate analysis of target markets, understanding the needs and tastes of foreign consumers, and evaluating competitors are the first necessary steps in this direction. Producing high-quality products in accordance with international standards, attractive and modern packaging, and diversifying products can help create attractiveness and strong branding. Using effective branding and advertising strategies, especially in the digital space and social networks, plays an important role in increasing awareness and attracting new customers. Establishing extensive distribution networks and cooperation with local distributors ensures easy access to products for consumers. Competitive pricing and offering discounts and special offers can also help attract and retain customers. Content marketing and cooperation with influencers and famous people can have positive effects on the introduction and popularity of products. Active presence in international exhibitions and events provides good opportunities for direct introduction and communication with new customers and distributors. Local research and adaptation of products to different needs and tastes of the target markets are also of particular importance. Finally, using the combination of these comprehensive strategies and approaches and appropriate to the conditions of different markets, can bring Iranian beverages to a suitable position in the international markets and increase their market share significantly. Continuous

application of these strategies and continuous evaluation of results will help ensure long-term success and sustainability in this direction.

In general, in today's world, where globalization and intense competition of international markets are rapidly evolving, Iranian beverage companies need a strategic and comprehensive approach to penetrate and stabilize their position in these markets. The results of this research show that management information systems can play an essential role in supporting the international marketing strategies of these companies. Designing and implementing a comprehensive MIS model, which is developed based on the specific needs and challenges of target markets, can help Iranian beverage companies not only compete in international markets, but also become major players in these markets over time. This research has managed to identify and explain the key factors of success in this field by using the basic theory and validated the proposed model accurately and scientifically. This model allows companies to make smart decisions based on accurate information through the aggregation and analysis of marketing-related data. This is especially important in the face of rapid market changes and the diverse needs of international consumers. Therefore, the proposed model of this research can help companies to optimize their operational processes and increase their competitiveness in international markets by creating accurate and targeted marketing strategies. On the other hand, due to the increasing importance of new technologies, such as artificial intelligence and big data analysis, this model can help companies to optimize their marketing by using these technologies and quickly respond to the needs of target markets. In addition, this research showed that adapting to local cultures and understanding the needs of consumers in different global markets is of great importance. This issue is especially effective in designing new products and improving branding strategies of Iranian beverage companies. By using this model,

Iranian companies can simultaneously focus on the challenges and opportunities of international markets and optimize their strategies through the detailed analysis of consumer behavior and the identification of market trends. Finally, this research shows that combining marketing strategies based on accurate information, using new technologies, and paying attention to the cultural and local needs of target markets can lead to sustainable success of Iranian beverage companies in international markets. By applying this comprehensive approach, Iranian companies can stand up well against their competitors and take a larger share of global markets, and in this way, achieve a stronger and more stable position in the global arena. At the end, the practical suggestions of the research were presented:

- The research should identify and analyze the target markets more precisely. For this purpose, the use of market analysis tools such as SWAT analysis (strengths, weaknesses, opportunities and threats) as well as the use of accurate statistical data can be helpful.
- Conducting field research and using consumer surveys can also help to better understand the needs and preferences of the target market.
- It is suggested that companies use new technologies such as artificial intelligence and machine learning to analyze market data and predict future trends. These technologies can help automate marketing processes and improve ad targeting.
- One of the other important suggestions is that the products are designed and developed in such a way that they are in harmony with the local needs and tastes of each market. For example, producing halal products for Muslim markets or using natural and healthy ingredients for health-conscious markets can be successful.
- Using digital marketing strategies such as social media advertising, search engine optimization (SEO), and content marketing can help attract new customers

and increase brand awareness. Also, it is essential to use digital data analytics to improve digital marketing strategies.

- Understanding and adapting to the cultural and social factors of each market can help improve communication with consumers and increase their loyalty. Conducting marketing campaigns that respect cultural identity and local values can have a significant impact on marketing success.

- It is suggested to organize training and professional development programs for management and marketing teams of companies. These programs can include training in the fields of information management, use of new technologies, and market analysis.

- Improvement and development of distribution networks can help better and faster access of products to the target markets. This includes cooperation with local distributors, use of new logistics technologies, and supply chain optimization.

- Using continuous feedback systems from customers can help to quickly identify problems and new needs. These feedbacks should be analyzed periodically and used to improve products and marketing strategies.

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RESEARCH ARTICLE   **Open Access**

Designing and Validating the Model of Exit from Organizational Mobbing

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Abstract
The present study was conducted to design and validate the model of exit from organizational mobbing in the Education Organization. It is an applied-developmental research. In terms of how to collect data, it is a cross-sectional survey. To achieve the research purpose, the exploratory mixed research design was employed. Qualitative meta-synthesis was used to identify the model categories and the partial least squares approach was utilized to validate the model. Data analysis in the qualitative phase was conducted via Maxqda software and in the quantitative phase via the Smart PLS software. The statistical population included managers and employees of the Education Organization. The sample volume was estimated equal to 140 persons by means of Cohen's statistical power analysis. Cluster-random sampling was used for sampling. Finally, the final indicators were categorized into 13 main categories and 72 subcategories. Conflict management and stress management led to exit from organizational mobbing in the Education Organization through improving the professional capability of employees, organizational intimacy, and emotional intimacy.
Keywords: *Organizational Mobbing, Deviant Behavior, Education Organization.*

Introduction

Organizational mobbing is a collection of improper, threatening, humiliating and harsh behaviors that are frequently occurred to the victim by some people in the organization environment. These behaviors include rumor mongering, secluding, verbal or physical violence, and discrediting of other employees (Gil-Monte et al., 2024). Such behaviors have destructive consequences for the victim that passivity and reduced efficiency and effectiveness are the first result of it. Fear, anxiety, job stress, reduced self-confidence and mental and psychological problems are other consequences that finally encourage the victim to leave the organization (Kras et al., 2023). Through considering the importance of the issue of organizational mobbing and the obtained negative results from it, gaining knowledge and preventing mobbing

behaviors have an effective role in improving mental and physical health of human resources and enhancing efficiency of the organization. For this reason, organizations actively try to control mobbing and are looking for a strategy to exit the problems accompanied by such misbehaviors in the organization (Mousavi et al., 2022).

Mobbing and bullying behaviors are one of the basic damages in any organization that decrease organizational performance at a high rate. Empirical evidences reveal that mobbing behavior is observed in public organizations more than the private organizations. The reasons for creating mobbing behaviors in the organization can be looked for in features such as weak organizational communications, narcissism, political behaviors, inefficient performance assessment, organizational climate and so on.

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One of the severe forms of misbehavior in the organization and among employees in a work environment is organizational mobbing (Erten & Çögenli, 2024). Mobbing for organizations is a serious problem because it challenges their moral integrity. Emergence and prevalence of bullying and mobbing behaviors in the organization corrupts human resources' trust in the organization and leads to reduced constructive and multilateral communications at the work environment, and reduction of team and organizational performance (Glaveli et al., 2023). Mobbing at the workplace is a kind of mental aggression including continuous, repetitive and long encounter of employees with multiple insulting and intimidating behaviors that are seriously and negatively effective on mental and physical health of people and have nowadays become one of the organizational, moral and legal centers of attention (Ebadi Bashir, 2022).

Generally, mobbing behaviors are led to non-effective behaviors and lack of honesty in the organization (Ibrahim et al., 2021). Narcissistic executive directors in organizations entitle themselves to misbehave aggressively with others and thus consolidate their position in the organization (Yildiz et al., 2021). Now it is necessary for organizations to prevent mobbing at the work environment at the beginning and decrease its destructive and negative effects as much as possible. These negative effects are not only effective on reduced well-being of the victims of these behaviors and decrease quality of working life of human resources intensely but also have destructive outputs related to the individual, team and the organization. For this reason, researchers in the fields of psychology, sociology and management across the world are trying to obtain a strategy to exit from it besides identifying its roots (Fateh Nezhad & Zarei, 2021).

The issue of deviant behaviors in Education has a higher importance. Hostile behaviors of teachers and mobbing in schools and educational system has irreparable damages for the society. Such learning and educative issues severely influence children

and adolescents and endanger health of communities in future (Chechi & Navdeep, 2023). On the other hand, mobbing behaviors among teachers and inside the education system have destructive consequences for the teachers. Organizational silence, reduction of job motivation and severe reduction of effectiveness of teaching are the issues that show suffering from mobbing in the educational system (Karatepe et al., 2022). Considering the key role of education in guaranteeing the future of country and since teachers and employees are the main source and the only asset of this organization, working conditions in the education should highly be suitable. Any shortage in working conditions in the Education Organization is led to reduced efficiency and effectiveness of its employees that will finally have irreparable damages for the country in future (Hosseini et al., 2024). Social pathology in the field of education and finding suitable strategies in order to eliminate them are the essential and basic needs of any society. Deviant behaviors are prevalent and debilitative disorders and damages which have challenges and problems for students, school principals and assistants, teachers and students' families. Increasing of behavioral abnormalities among the students in schools leads to their academic failure and getting away from purposes of human development (Khoshfekr Moghadam, 2023). In pathology of human resource management system in the educational system of Education in Iran, it was determined that one of the considerable components is organizational misbehaviors such as mobbing, bullying and hypocrisy (Mirsepasi et al., 2023). Pathology of administrative bureaucracy of the Education Organization in Iran also shows that the possibility to develop different kinds of deviant behaviors like organizational mobbing is one of the disadvantages of the traditional and hierarchical system (Susaraei et al., 2023).

Overall, it can be stated that organizational mobbing in the Education Organization in Iran is a destructive phenomenon that both has bad and long-term effects for teachers and

employees and endangers educational issues of children and adolescents. Given the key role of this organization in depicting societies in future, those problems which threaten quality of working life in this institution must seriously be considered. Given the importance of this issue in upstream documents like the comprehensive scientific map of the country, confronting any destructive behavior in the education environment and higher education of the country has been emphasized. Studying this phenomenon is highly important from a negative viewpoint too, as non-confrontation with organizational mobbing and strategic decision-making to exit from this phenomenon can encounter the education system with several problems. The direct effects of it will be appeared in teachers' silence and isolation, reduced motivation and job effectiveness, and hence, academic and educational failure of students. From scientific perspective, studying the phenomenon of organizational mobbing in education has been ignored from the viewpoint of researchers. Of course, some studies have been conducted which focus on deviant behaviors (Pourmokhtari & Karimi, 2016; Salajeghe et al., 2017; Khalili Abbasabadi, 2019; Hakak & Ghahremani, 2022; Khoshfekr Moghadam, 2023) in the Education Organization in Iran but no independent study has investigated organizational mobbing in the Education Organization in the country. This shows numerous research gaps in this field. Hence, it is essential to perform a scientific and applied study to propose a comprehensive model for encountering with organizational mobbing in the education actively and pioneeringly. Theoretical contribution and the role of this research in increasing knowledge is that it has been tried to recognize infrastructural constructs of exit from organizational mobbing in the Education Organization in Iran via an exploratory approach in order to fill the existing research gap and then determine and explain the model of relations among the constructs. This question will be responded: how is the model of exit from organizational mobbing in the Education Organization?

Theoretical Principles

Mobbing in Persian has been applied as mobocracy (Mobasheri & Teimuri, 2023), hooliganism (Mousavi et al., 2023) and spiritual terror (Nouri Samin et al., 2020) but it has mostly been translated as organizational mobbing. This concept was defined by Heinz Leymann (1996) as destructive and harsh behaviors that provide the ground for destructive stresses in an organizational environment by a group of people who violate norms. Leymann believes that mobbing behavior is a behavior that lasts for at least six months and one of its signs appeares each week; also, people should accept that they have been the victim of such behaviors (Bedzik et al., 2023). Mobbing is one of the common phenomena in several organizations which has considerable negative effects on various elements of the organization. From individual perspective, mobbing has numerous destructive effects (Savidi et al., 2017).

Organizational mobbing is a group of emotional and bullying attacks that target special people. Level of mobbing has recently been increased in organizations. Mobbing that sometimes is referred to as emotional tyranny causes to destroy the personality of an employee in terms of regular, continuous and permanent accomplishment of organizational tasks through creating mental pressures on the intended person (Martins et al., 2023). In the organizational world, mobbing occurs in different forms such as threatening, repressing, frustrating and depriving one person or a group of people. Mobbing sometimes occurs intangibly and sometimes tangibly that its aim is to convert an active employee into an inactive and passive employee and then omit him/her. Besides individual consequences, mobbing also affects the social environment governing the organization and employment conditions. Increasing of mobbing actions at the work environment can be led to stagnation of positive cultural values in the organization

and reduce employees' job motivation through weakening their trust and commitment toward the organization and imposes job burnout on employees (Saeidipour et al., 2021).

Organizational mobbing is a subset of "organizational misbehavior". Organizational misbehavior is applied to performing any action in the organization that the individual is not allowed to do it. Such behaviors have negative and destructive consequences for the organization (Ackroyd & Thompson, 2022). Mobbing is composed of three players including "mobber, victim, and witness". In this relationship, mobber is the individual that shows improper and destructive behaviors. Consequences of mobbing for the victim include physical, mental and emotional harm. The witness can also be in active form that attempts to interfere in the problem and solve it or be inactive and just sees the adventure (Acquadro et al., 2021). Mobbing in an organization is divided into three types, i.e. "downward" mobbing, "upward" mobbing and "horizontal" mobbing. Downward mobbing that is the most common type of mobbing is imposed on employees by managers and supervisors and its main reasons return to poor leadership style and inattention of managers. Upward mobbing occurs from low levels of the organization to high levels and finally, horizontal mobbing occurs among employees and colleagues. This issue is the result of weak structures, lack of adequate supervision, inefficient communications, improper culture and external pressures (Ciby & Sahai, 2021).

In literature related to deviant behaviors and organizational misbehavior, the concept of "mobbing" is sometimes considered synonymous with the concept of "bullying" but some theoreticians believe that these two concepts are different. The term "workplace bullying" is usually used in individual form. Bullying is mostly considered for managers who try to dictate their governance and power to the employees but mobbing in an organization is related to team behavior that a number of employees perform destructive behaviors such as rejecting a colleague, dictating to colleagues, spreading rumors about colleagues and any case that is not among organizational etiquette (Hollis, 2023). The concept of organizational mobbing is defined in aggressive and physical injuries and has entered the work environment from the existing bullying in schools. This is while mobbing in the workplace controls more complex behaviors that explain this phenomenon and is accompanied by more annoying behaviors that cause too much negative pressure on other employees (Mhaka & Rampa, 2024).

Therefore, it can be said that the issue of organizational mobbing in the education in Iran has not been occurred integratedly. There are related research in the field under study which have been focused on deviant behaviors in education. There are also other studies in which organizational mobbing has been explored in other organizations. Lack of adequate studies reveal that in academic communities, researchers have not paid adequate attention to this topic. Inattention of researchers to organizational mobbing in education in Iran is a matter worthy of consideration and it seems that conducting a thorough study with a local viewpoint and an exploratory approach is necessary.

Methodology

This study is an applied-developmental research. It aims to propose a model to exit from organizational mobbing in the Education Organization in Iran. It is a cross-sectional survey in terms of how to collect data. In order to achieve the research purpose, exploratory mixed research (qualitative-quantitative) was employed.

In the first section, qualitative meta-synthesis was used to identify the research categories. In this section, the required information was collected based on various keywords. Also, authentic domestic and foreign sources were introduced for gathering the required data. In this study, data and information in cited resources and databases was used. Thus, through exploring and identifying the studies via search engines of the National Library and websites such as

Jahad Daneshgahi, Noor specialized magazines, National Publications Database and foreign magazines with keywords related to the research purpose, 33 studies were totally found.

In the quantitative section, the statistical population included managers and employees of the Education Organization. To estimate the sample volume, Cohen's power analysis (1992) and G*Power software were utilized. At the confidence level 95% and the effect size equal to 0.15 and power of test equal to 80%, the minimum sample size was estimated equal to 140 persons. Sampling in the quantitative section was carried out by means of cluster-random sampling.

Validity of the qualitative section was evaluated and confirmed based on Lincoln and Goba's suggestion, four indexes of transferability, verifiability, credibility and reliability from the viewpoint of associated professors. In order to explore reliability of the qualitative section, Holsti method was used and "Percentage of Agreement Observation" was obtained equal to 0.682 that is greater than 0.6; hence, validity of qualitative analysis is confirmed.

Having distributed the questionnaires in the selected sample to measure its validity, three methods of construct validity (external model), convergent validity (AVE) and discriminant validity were explored. AVE value for all variables should be greater than 0.5. Value of composite reliability and Cronbach's alpha of all dimensions of the questionnaire should be greater than 0.7 (Azar & Gholamzadeh, 2019). The results related to each index have been represented in external fit of the model.

Categories of the model to exit from organizational mobbing in the Education Organization were identified through thematic analysis. In order to validate the model, partial least squares approach was used. Data analysis in the qualitative phase was conducted via Maxqda software and in the quantitative phase via the Smart PLS software.

Findings

In the quantitative section, viewpoints of 140 managers and employees of the Education were employed. In terms of gender, 99 persons (70%) were male and 41 persons (29%) were female. In terms of age, 25 persons (17%) had less than 35 years old, 62 persons (44%) had between 35 and 45 years old, and 53 persons (37%) had more than 45 years old. In terms of education, 33 persons (23%) had bachelor's degree, 65 persons (30%) had master's degree, and 42 persons (30%) had PhD. In terms of work experience, 37 persons (26%) had less than 10 years of work experience, 49 persons (35%) had between 10 to 15 years of work experience, and 16 persons (11%) had more than 20 years of work experience.

Table 1.
Demographic characteristics

Demographic characteristics		Frequency	Percentage
Gender	Male	99	71%
	Female	41	29%
Age	Less than 35 years old	25	18%
	35 to 45 years old	62	44%
	45 years old and older	53	38%
Education	Bachelor's degree	33	24%
	Master's degree	65	46%
	PhD	42	30%
Work experience	Less than 10 years	37	26%
	10 to 15 years	49	35%
	15 to 20 years	38	27%
	More than 20 years	16	11%
Total		140	100%

In the first step, key categories of the model were identified by means of meta-synthesis. Meta-synthesis is one of the methods of meta-study that evaluates other accomplished studies and from this aspect, it is referred to as evaluation of evaluations. In order to achieve the research purpose, meta-synthesis based on Sandelowski and Barroso's model was used.

| Proposing the research questions | → | Systematic exploration of texts | → | Searching and choosing suitable resources | → | Extracting the information of resources | → | Data analysis and synthesis | → | Quality control | → | Representing of findings |
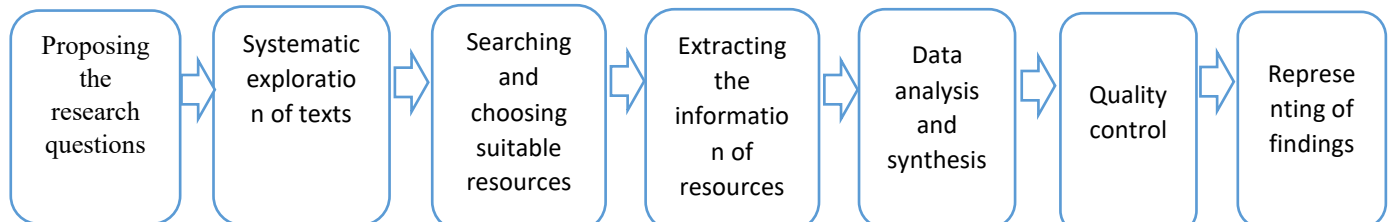
Figure 1. *The seven-step meta-synthesis method (Source: Sandelowski & Barroso, 2007)*

Proposing the research questions: These questions are compiled based on four indexes of what, who, when and how.

Table 2.
Research questions

Index	Question
(What)	What are the infrastructural categories of the model to exit from organizational mobbing in the Education Organization in selected provinces?
(Who)	Who are the role players in the model to exit from organizational mobbing in the Education Organization in selected provinces?
(When)	Choosing the existing works between the years 2010-2024
(How)	How is the relationship among the categories of the model to exit from organizational mobbing in the Education Organization in selected provinces?

Systematic review of texts: In the second step, the research data was gathered through previous reliable documents. As a result of this search and by inserting the related keywords, 33 studies were totally found.

Table 3.
Keywords

Keywords
Organizational hooliganism
Organizational bullying
Exit from organizational hooliganism
Hooliganism in education
Bullying in education

Searching and choosing suitable texts: In the third step, each article was evaluated qualitatively using CASP method with 10 conditions. This process is shown in Figure 2.

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┌─────────────────────────────┐
│   Articles found (N=33)      │
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│ Selected articles for        │
│ evaluation                   │               ┌─────────────────────────────┐
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              │                                 │      final evaluation        │
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│ Final selected articles (N=23)│
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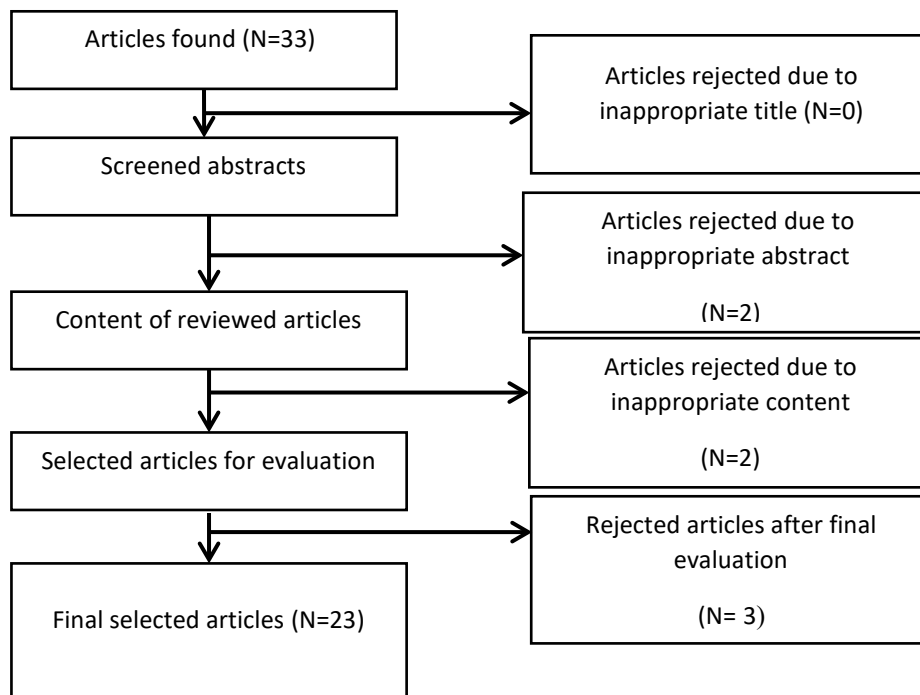
Figure 2. *Process of revision and selection*

Finally, after four stages of filtration, 7 articles among 33 articles were omitted and 26 articles were selected for data analysis.

Extracting the research data: In step four, data of the articles was categorized in a table. This table includes the below information: ID information of the research: title, name and family name of the authors and year of publication. Information of the key method: research method and purpose. Information of main findings: research results and findings.

Analysis of qualitative findings: First, all extracted factors from articles were considered as identifier and then similar concepts were categorized in larger and more comprehensive categories so that explanatory dimensions can be proposed in the form of main and secondary categories.

Quality control of analysis: In order to evaluate reliability of qualitative meta-synthesis, the selected results were given to the experts. After evaluation, the Kappa coefficient was calculated equal to 0.611 which is favorable, since it is greater than 0.6.
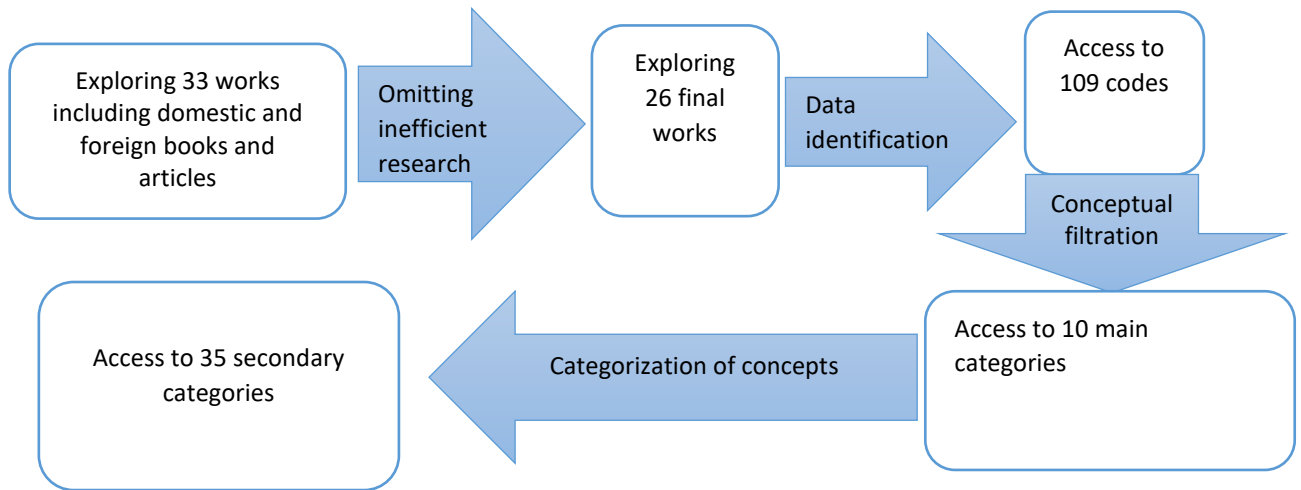
Figure 3. *Output process of quality control of research categories*

Representing the report and research findings: In the seventh step, findings of previous research are presented via meta-synthesis. Among the categories extracted from texts of related articles, 13 main categories and 72 secondary categories were obtained by omitting synonymous and frequent indexes and finally via categorization of final indexes. They are represented in Table 4.

Table 4.
Main and secondary categories of research

Dimensions	Main category	Secondary category	Source
Consequence	Exit from organizational mobbing	1) Reducing norm-breaking and behaviors contrary to common law of the organization	Mirzaei and Pourabbas Khader (2023)
		2) Reducing organizational misbehavior of employees	Hosseini (2023)
		3) Reducing rumors and lies in the organization	
		4) Reducing anomie and organizational abnormality	
		5) Lack of grouping and opposition in the organization	Fakharizadeh Najafabadi et al. (2023)
		6) Reducing absenteeism and circumvention	Buriro et al. (2022)
		7) Reducing colleagues' annoyance in the work environment	Kaur (2023)
	Professional capability of employees	8) Power of analysis of problems	Farmani et al. (2022)
		9) Creativity and innovation at work	Moffat et al. (2023)
		10) Human resources skill and proficiency	Mousavi et al. (2023)
		11) Alignment of individual and organizational purposes and values	Sepahvand et al. (2021)
		12) Accuracy and concentration at work	Hosseini (2023)
	Human resources development	13) Improving job skills	Molavi et al. (2019)
		14) Strengthening general and specialized knowledge	Kmieciak (2024)
		15) Development of individual competencies	Farmani et al. (2022)

		16) Improving functional efficiency of employees	Mehmood et al. (2024)
Causal factors		17) Improving effectiveness of performing job affairs	Tuckey et al. (2022)
	Emotional intimacy	18) Feeling of satisfaction of being together	Safaei et al. (2024)
		19) Employees' satisfaction with each other	
		20) Honesty and righteousness of employees	
		21) Criticizability and admitting mistakes	Agha Mirzaei and Nategh (2022)
		22) Employees' respect to each other	
		23) Recognizing personal spirit of employees from each other	Homayoni et al. (2015)
	Organizational intimacy of employees	24) Employees' developing friendly relations with each other	
		25) Employees' interest to cooperate	Mendiratta & Srivastava (2023)
		26) The spirit of teamwork	Kaur (2023)
		27) Joy and exhilaration in employee relations	
		28) Cooperation at the time of problems	Fath Alian et al. (2022)
		29) Attachment and interest among employees	
	Education management	30) Senior management's support from appropriate workplace behaviors	Bourrier et al. (2022)
		31) Capitulation and practical commitment of managers to norms of the organization	
		32) Managers' decisive and clear dealing with workplace mobbing	Taki et al. (2022)
		33) Clear management rules and regulations in the field of workplace bullying	Farmani et al. (2022)
		34) Lack of workplace bullying of senior managers	Fath Alian et al. (2022)
		35) Lack of sovereignty of directive management and delegation of authority	Mehmood et al. (2024)
	Organizational Structure	36) Flexible and collaborative structures	Mendiratta & Srivastava (2023)
		37) Improving and reinforcing organizational communications	
		38) Mobilization of resources and possibilities toward the objective	
		39) Development of informal and multilateral relations	Taki et al. (2022)
		40) Revision and reengineering of the structure	
	Culture of the Education	41) Creating an ingenious culture	Teke'ei et al. (2021) Hazratian et al. (2021) Molavi et al. (2019)
		42) Risk-taking culture	
		43) Growth and developer culture	
		44) Responsive culture	
		45) Culture of collaborative decision-making and teamwork	
		46) Learning culture	

		47) Tolerance-oriented organizational culture	
Background factors	Organizational climate	48) Problem-oriented culture	
		49) Atmosphere of cooperation	Hayat & Afshari (2021)
		50) Reinforcing positive and constructive behaviors of employees	
		51) Encouraging employees to cooperate	
		52) Sense of joy in the work environment	Kmieciak (2024)
		53) Feeling of trust in the work environment	
	Job factors	54) proportion of the individual's characteristics with the jobs	Nouri Samin et al. (2019)
		55) Promotion and meritocratic career advancement	
		56) Career development and variety of tasks	
		57) Job enrichment and delegation of authority	
		58) Lack of conflict among job roles	
		59) Clarity of job duties	
	Payment and compensation system	60) Providing welfare facilities to employees	Mousavi et al. (2022)
		61) Satisfying employees with adequate salary and benefits	Sawidi et al. (2017)
		62) Providing incentives and rewards based on tenure or record of service	
		63) Granting material and spiritual rewards proportional to employees' performance	Mendiratta & Srivastava (2023)
Interfering factors	Stress management	64) Creating peace in the workplace	Abdi et al. (2022)
		65) Responding to work issues and problems	
		66) Reducing ambiguity in roles and duties	Hayat & Afshari (2021)
		67) Alignment with employees' problems	
		68) Reducing job stress	Sepahvand et al. (2021)
		69) Lack of conflict in job duties and organizational departments	
	Conflict Management	70) Eliminating conflict of interests in organizational jobs and departments	Safaei & Galij (2022)
		71) Solving problems of employees and departments peacefully	
		72) Preventive recognition of potential conflict factors	

According to above results, the model of exit from organizational mobbing in the Education Organization has been displayed in Figure 4.
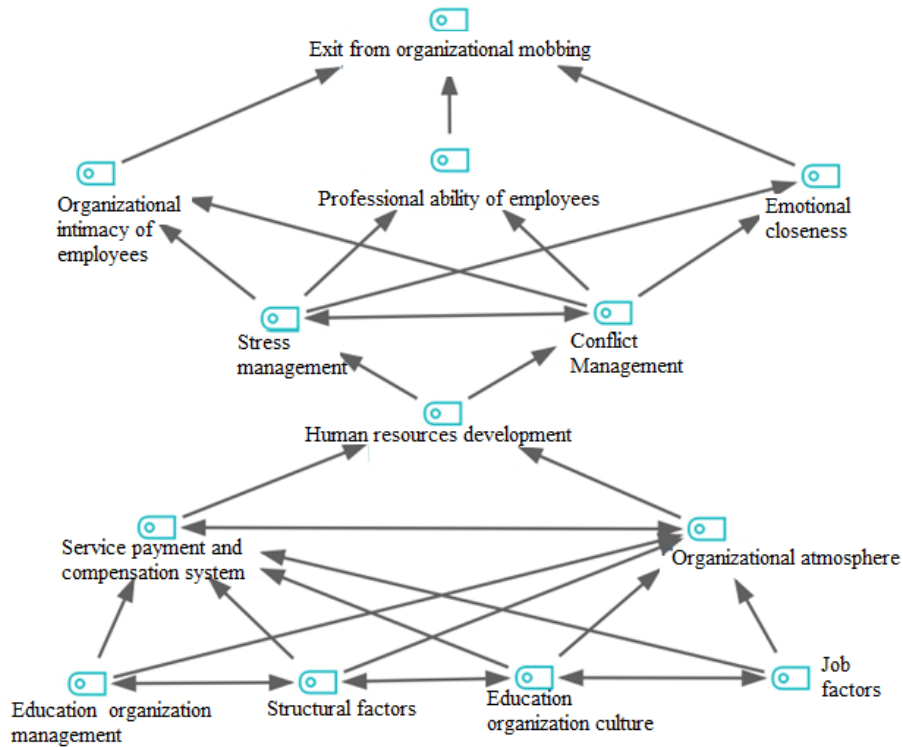
Figure 4. *Model of exit from organizational mobbing in the Education Organization*

Having proposed the model of exit from organizational mobbing in the Education Organization, the partial least squares approach was used for validation.
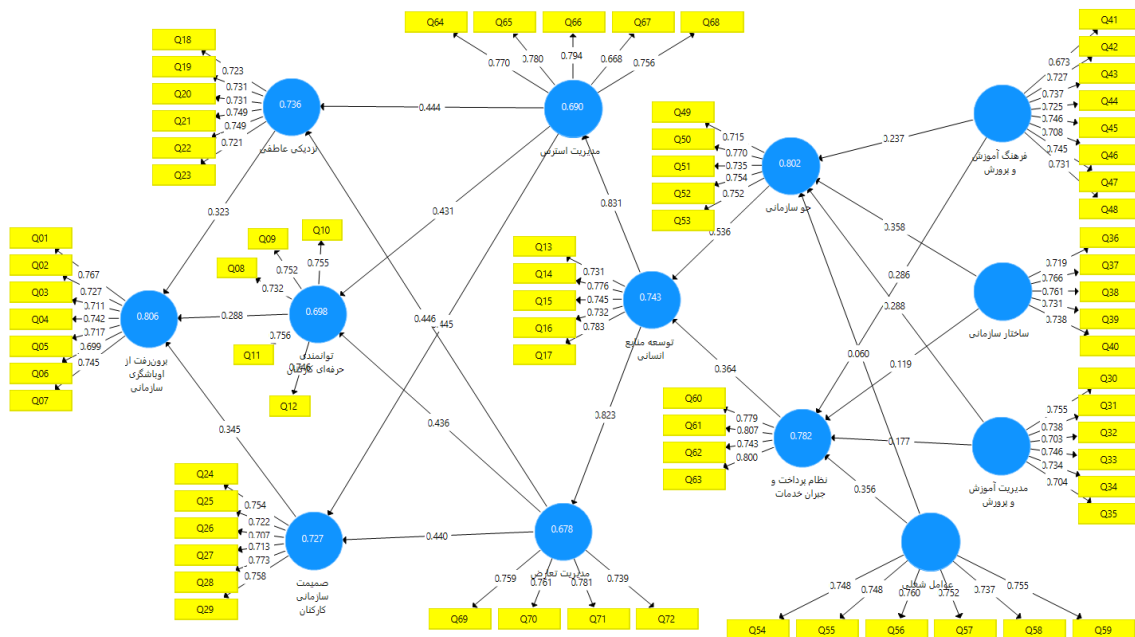

Figure 5. *Validating the model of exit from organizational mobbing in the Education Organization (standard estimation)*
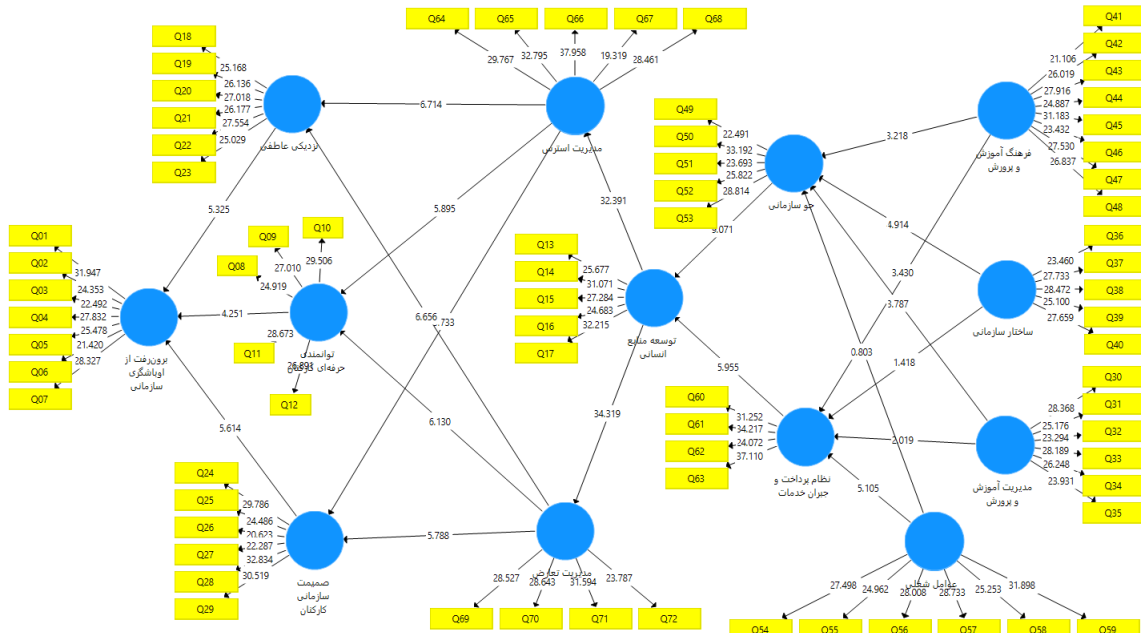
Figure 6. *Validating the model of exit from organizational mobbing in the Education Organization (significance)*

Summary of the results of evaluating goodness of fit of the measurement model is represented in Table 5.

Table 5.
Measuring the model of exit from organizational mobbing in the Education Organization

Main constructs	Cronbach's alpha	Composite reliability (CR)	Rho coefficient	AVE
Exit from organizational mobbing	0.854	0.854	0.889	0.568
Professional capability of employees	0.804	0.804	0.864	0.556
Human resources development	0.810	0.810	0.868	0.552
Organizational climate	0.800	0.800	0.862	0.545
Organizational structure	0.797	0.798	0.860	0.563
Organizational intimacy of employees	0.833	0.833	0.878	0.525
Job factors	0.845	0.848	0.885	0.533
Culture of education	0.870	0.871	0.898	0.570
Management of education	0.825	0.825	0.873	0.578
Stress management	0.810	0.811	0.868	0.539
Conflict management	0.756	0.756	0.846	0.612
Emotional intimacy	0.829	0.829	0.875	0.568
Payment and compensation system	0.788	0.789	0.863	0.556

Relations among main constructs are recognized as internal model (structural section) which were explored based on path coefficient and t-statistic. Summary of results of testing relations among the main constructs is represented in Table 6.

Table 6.

Testing relations of constructs of organizational mobbing in the Education Organization

Relation	Path coefficient	t-statistic	Significance	Effect size	Result
Professional capability of employees → exit from organizational mobbing	0.288	4.251	0.000	0.119	confirmed
Human resources development → stress management	0.831	32.391	0.000	2.224	confirmed
Human resources development → conflict management	0.823	34.319	0.000	2.107	confirmed
Organizational climate → Human resources development	0.536	9.071	0.000	0.353	confirmed
Organizational structure → Organizational climate	0.358	4.914	0.000	0.126	confirmed
Organizational structure → payment and compensation system	0.119	1.418	0.157	0.013	Rejected
Organizational intimacy of employees → exit from organizational mobbing	0.345	5.614	0.000	0.161	confirmed
Job factors → Organizational climate	0.60	0.803	0.422	0.004	Rejected
Job factors → payment and compensation system	0.356	5.105	0.000	0.137	confirmed
Culture of Education → organizational climate	0.237	3.218	0.001	0.050	confirmed
Culture of Education → payment and compensation system	0.286	3.43	0.001	0.065	confirmed
Management of Education → organizational climate	0.288	3.787	0.000	0.077	confirmed
Management of Education → Payment and compensation system	0.177	2.019	0.044	0.026	confirmed
Stress management → professional capability of employees	0.431	5.895	0.000	0.164	confirmed
Stress management → organizational intimacy of employees	0.445	5.733	0.000	0.193	confirmed
Stress management → emotional intimacy	0.444	6.714	0.000	0.199	confirmed
Conflict management → professional capability of employees	0.436	6.13	0.000	0.167	confirmed
Conflict management → organizational intimacy of employees	0.440	5.788	0.000	0.189	confirmed
Conflict management → emotional intimacy	0.446	6.656	0.000	0.201	confirmed
Emotional intimacy → exit from organizational mobbing	0.323	5.325	0.000	0.128	confirmed
Payment and compensation system → Human resources development	0.364	5.955	0.000	0.163	confirmed

Path coefficients in this section show intensity and direction of the relationship and as t-statistic is greater than 1.96, it shows that the path coefficients are significant (Cohen, 2013). Based on the results, effect size of all independent variables was above the average level in all cases, i.e. 0.15 and in some cases, it was greater than 0.35, i.e. it was strong.

Coefficient of determination (R^2) and predictive relevance (Q^2) were used to measure predictive power of the model (Chin, 1998). The predictive relevance was introduced by Stone and Geisser. For this reason, it is sometimes known as Stone-Geisser index too. If value of (Q^2) is positive, it shows that the model has a suitable predictive power (Hair et al., 2021). Indexes of predictive power of the model (R^2) and (Q^2) are reported in Table 7.

Table 7.

Predictive power of the model of exit from organizational mobbing in the Education Organization

Main constructs	Coefficient of determination	Adjusted coefficient of determination	Q2
Exit from organizational mobbing	0.806	0.805	0.401
Professional capability of employees	0.698	0.696	0.367
Human resources development	0.743	0.742	0.396
Organizational climate	0.802	0.799	0.415
Organizational intimacy of employees	0.727	0.726	0.371
Stress management	0.690	0.689	0.370
Conflict Management	0.678	0.677	0.371
Emotional intimacy	0.736	0.734	0.372
Payment and compensation system	0.782	0.780	0.450

Based on the results of Table 7, coefficient of determination of endogenous constructs of the model is favorable. Value of coefficient of determination of exit from organizational mobbing was estimated equal to 0.806. This reveals that variables of the model could explain 81% of changes in exit from organizational mobbing.

Goodness of fit of the model was evaluated using GOF, RMS, and SRMR indexes. For GOF index, values 0.01, 0.25 and 0.36 are acceptable as weak, moderate and strong values. For RMS_theta index, values below 0.12 show proportion of the model and for SRMR index, values below 0.1 and highly strictly less than 0.8 are acceptable (Habibi & Jalalnia, 2022). In this study, GOF index was obtained equal to 0.642 which is greater than 0.36. The RMS_theta index was obtained equal to 0.105 which is less than 0.12 and finally the SRMR index was calculated equal to 0.054 which is less than 0.08. Thus, goodness of fit of the model is favorable.

Conclusion and Suggestions

The present study was carried out to propose and validate the model of exit from organizational mobbing in the Education Organization. Based on the primary model, it was determined that cultural, structural and job factors and management of education are effective on organizational climate and payment and compensation system. This has been confirmed in studies done by Teke'ei et al. (2021), Hazratian et al. (2021) and Molavi et al. (2019). Similarly, it was shown that the above factors are effective on human resources development which is effective on conflict management and stress management. The above results have been referred to in studies performed by Molavi et al. (2019), Kmieciak (2024), Farmani et al. (2022) and Mehmood et al. (2024). The results demonstrated that conflict management and stress management cause to exit from organizational mobbing in the Education Organization through improving professional capability of employees, organizational

intimacy and emotional intimacy. These issues have been referred to in studies done by Homayuni et al. (2015), Mendiratta and Srivastava (2023), Kaur (2023), and Fath Alian et al. (2022). And from this aspect, they are consistent with the results of the present study.

Concerning professional capability of employees, it is suggested to enhance creativity and innovation at work besides improving the power to analyze the problems. What is important in exit from organizational mobbing is human resource skill and proficiency and of course alignment of individual and organizational purposes and values. This can be achieved through accuracy and concentration at work. Well-trained employees are totally aware of expectations, tasks and responsibilities. Hence, they need cheaper supervision that makes it possible for the organization to allocate these resources to its strategic attempts. Leadership has a considerable effect on success of each organization. As a result, preparation and retaining of talent is highly important for change in these roles. Offering better knowledge and skill to employees prepares them to reach the organization to a higher level. Clearly, high quality education and development of employees is highly important for organizational success. However, these plans do not occur randomly. They require accurate planning and implementation. Under such conditions, how to manage human resources and the compiled programs for employee's training become highly important.

Concerning human resources development, it is suggested to develop individual competencies via improving job skills and reinforcing general and specialized knowledge. Exit from organizational mobbing depends on improving functional efficiency of employees and effectiveness of performing job affairs. Total awareness of principles, characteristics and techniques of human resources development and meritocracy management is a definite and serious need for all public, private, profit and non-profit institutions and requires to adopt

modern and more distinct managerial strategies than other competitors and creating competitive advantage to continue its survival.

Concerning emotional intimacy, employees' honesty and righteousness is necessary for employees' feeling of satisfaction with each other. In this regard, employees' criticizability and admitting mistakes and respecting each other are effective on exit from organizational mobbing. Likewise, recognition of employees' personal spirit from each other is an important element in this regard.

Concerning employees' organizational intimacy, it is suggested to improve the spirit of teamwork besides developing employees' friendly relations and creating interest for cooperation. Exit from organizational mobbing requires joy and exhilaration in employees' relations and cooperation while solving the problems. It is suggested to relevant managers to try to enhance attachment and interest among the employees.

Concerning education management, senior management support from accurate job behaviors and practical capitulation and obligation of managers from norms of the organization are suggested. In this regard, managers' crucial and obvious dealing with workplace mobbing is needed which can be achieved through compiling clear managerial rules and regulations in the field of workplace mobbing. Also, lack of workplace bullying of senior managers and lack of sovereignty of directive management and lack of delegation of authority should be taken into account in the above-mentioned management.

Concerning organizational structure, it is suggested to improve and reinforce organizational communications through creating flexible and participatory structures. Exit from organizational mobbing requires mobilization of resources and possibilities toward the purpose and of course developing informal and multilateral relations. Thus, it is recommended to relevant managers to review and re-engineer the construct in this regard.

Concerning culture of education, it is suggested to establish the growth and developer culture in the Education Organization by creating ingenious and risk-taking culture. Exit from organizational mobbing requires implementing a responsive culture and it is possible to help exit from organizational mobbing if there is participatory decision-making culture and teamwork. In addition to above cases, establishment of learning culture leads to create tolerance-oriented organizational culture and relevant managers can be effective on exit from organizational mobbing through the use of problem-oriented culture.

Concerning organizational climate, it is suggested to reinforce positive and constructive behaviors of employees besides sublimating the atmosphere of cooperation. Moreover, encouraging employees to cooperate creates sense of joy at workplace and what is important in exit from organizational mobbing is creating trust in the work environment which should be considered by relevant managers more than ever.

Concerning job factors, it is suggested to take action toward promotion and meritocratic career advancement by observing the proportion of the individual's characteristics with the jobs. Exit from organizational mobbing requires job development and variety of tasks and of course job enrichment and delegation of authority. Thus, lack of conflict among job roles and clarity of the related tasks will help exit from organizational mobbing.

Concerning the payment and compensation system, it is suggested to attract employees' satisfaction with adequate salary and benefits besides offering well-fare possibilities to employees. Exit from organizational mobbing requires offering incentives and rewards based on tenure or job experience and granting material and spiritual reward proportional to employees' performance improves their performance and creates motivation in them.

Concerning stress management, it is suggested to respond to work problems through creating peace in the work environment. Exit from organizational mobbing requires reduced ambiguity in roles and tasks and conformity with employees' problems. In the same vein, compiling a program by managers of education to decrease job tension is recommended. Indeed, stress is a basic risk factor to create mental disorders like depression. Cognition skills in training stress management along with modifying perceptual processes, decreasing signs of stress and reducing negative assessments enhance positive assessments of the individual.

Concerning conflict management, it is suggested to omit conflict of interests in organizational jobs and departments through eliminating conflict in tasks of organizational jobs and departments. Exit from organizational mobbing is facilitated via peaceful solving of problems of employees and departments and of course preventive recognition of potential factors of conflict.

In the end, achieving the purposes of exit from organizational mobbing including reduction of norm breaking and behaviors contrary to common law of the organization, reduction of organizational misbehavior of employees, reduction of spreading rumor and lie in the organization, reduction of anomie and organizational abnormality, lack of grouping and opposition in the organization, reduction of absenteeism and circumvention, and decreased annoyance of colleagues at the work environment will be possible through implementing the above strategies.

Suggestions for future researchers

- The use of the present model of exit from organizational mobbing in the Education Organization in different provinces and comparing the obtained results
- Exploring the relationship among mechanisms of criterions of the model of exit from organizational mobbing in the Education Organization

- Comparing exit from organizational mobbing in the Education Organization with other countries
- Prioritization of beneficiaries of the model of exit from organizational mobbing in the Education Organization

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RESEARCH ARTICLE **Open Access**

Applying Preferred Information of the Decision Maker with Production Trade-Offs in the Process of Evaluating the Performance of Banks

Javad Gerami [1]

Abstract
One of the methods to apply preferred information of the decision maker (DM) in the process of evaluating the efficiency of banks is the method of production trade-offs in data envelopment analysis (DEA). In this paper, we propose a two stage network DEA framework for incorporating value-judgments in the form of production trade-offs to analyze the efficiency of banks. We obtain technical and cost efficiency from banks based on bank manager's opinion. We use the production trade-off method to consider the importance of each of the inputs, intermediate measure and outputs relative to each other to evaluate the performance of commercial banks. We show that by changing the production trade-offs matrix, the technical and cost efficiency scores of banks also change. We propose efficient targets for inefficient banks. At the end, we bring the results of the paper.
Keywords: Data envelopment analysis; Banking; Two stage; Preferred information; production trade-offs.

Introduction

The banking industry is one of the most influential industries in the economic markets. This industry is run by private government in different countries. Banks play an important role in the economy of a country. The performance of banks is of special importance for senior economic managers. For this reason, senior managers are always looking for a proper evaluation of the set of banks under their management. One of the techniques to evaluate the performance of a set of banks is DEA. This technique was initially presented by Charnes et al. (1984) based on mathematical programming. In the DEA, all banks can be evaluated in the same conditions. Banks with the best performance are known as efficient banks and other banks are inefficient. Another strength of DEA in evaluating the performance of banks is to provide a suitable target for inefficient banks. Inefficient banks should bring their activity

level to the activity level of efficient banks. In the process of evaluating the performance of banks, applying the opinion of bank managers is important. Because from the point of view of the bank management, some inputs and outputs in the evaluation process are more important than other inputs and outputs. There are several methods in DEA in order to consider the importance of inputs and outputs relative to each other in the banks' performance evaluation model. One of these methods is the production trade-offs method. Using this method, we can apply the importance of inputs and outputs to each other based on the opinion of managers in the evaluation model (Podinovski 2016).

The conventional DEA model does not incorporate a DM's preferences or value judgments in the evaluation process (Joro & Korhonen, 2015). Podinovski (2004) suggested production trade-offs method to incorporate DM's preferences in envelopment DEA model. He shown that it is

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equivalent to weight restrictions method in multiplier DEA model. Podinovski and Bouzdine-Chameeva (2015) shown how the technology thinking helps to prevent of the constitution of infeasible/inconsistent production relations. They investigated consistent weight restrictions in DEA. Podinovski and Argyris (2024) proposed production trade-offs in models of DEA with ratio inputs and outputs. They applied their approach for evaluating schools in England.

Traditional DEA models considered only the initial inputs and final outputs of the decision making units (DMUs) in the performance evaluation process and did not consider the intermediate measures. But DEA models based on the network structure consider these intermediate measures in the performance evaluation process. In order to analyze the performance of the two-stage network systems, we must measure the overall efficiency of the whole system and identify divisional efficiencies of the two stages. Also, we must obtain frontier projections for the inefficient DMUs (Yin et al. 2020, Kao 2024). Kaveh et al. (2020) developed appropriate marketing strategies in the form of scenario-based strategic planning in the life insurance market of mellat insurance company. They developed system dynamics and network DEA to formulate marketing strategies and the causal-loop diagram and then the flow-stock diagram for scenario-based strategic planning. Shojaie et al. (2022) proposed a comprehensive approach for evaluating efficiency in complex networks by integrating network DEA with the Malmquist productivity index. Their method developed the inherent challenge of accommodating negative data within the network efficiency evaluation framework. Marzban et al. (2022) proposed a best and most efficient ordering policies for different levels of the perishable food supply chain network in order to maximize the overall profit of the chain. They minimize social and environmental damage. Their supply chain includes a four-level supply chain of suppliers, manufacturers, distributors and retailers. Shirouyehzad et al.

(2024) evaluated the performance of the organization based on the total quality management CSFs and knowledge management CSFs. They analyzed and identified critical success factors of total quality management for evaluating organizational performance using a framework based on the knowledge management approach. They used data mining algorithms and a DEA model to evaluate the organizational performance by considering the success factors of knowledge management as inputs and success factors of total quality management as outputs. Nematizadeh et al. (2024) proposed an Alternative prioritization method in the presence of contextual variables. They applied their models for performance evaluation of provincial gas companies in Iran from 2013 to 2016.

In this paper, according to the structure of the banks under evaluation, we use two-stage DEA models to evaluate the performance of commercial banks. Different models have been presented in DEA to measure the performance of the two-stage network structure. However, each of these models is not necessarily suitable. In this paper, we present a suitable two-stage network DEA model for measuring the efficiency of banks. This model makes it possible to sensitivity analysis of the results in the presence of production trade-offs. By solving this model, we can calculate the efficiency scores of the first, second stages and overall efficiency score simultaneously for banks. This model somehow has a low amount of calculations. The model obtains the relationships between the efficiency scores of each banks in the first, second and overall stages. The model also provides efficient targets corresponding to inefficient banks. The model takes into account the relationship between production trade-offs between inputs, intermediate measures and outputs and their importance in the production process.

The concept of cost efficiency firstly was introduced by Farrell (1975). The cost efficiency of a DMU as the ratio of minimum cost for the production of current outputs with

input prices paid by itself to the actually observed cost. In cost efficiency models, outputs of the target DMU are evaluated by the minimum cost. Tone (2002) developed the cost efficiency evaluation model with different prices of inputs. Lozano (2013) proposed scale and cost efficiency analysis of networks of processes. Gerami et al. (2024) proposed fuzzy cost, revenue efficiency assessment and target setting in fuzzy DEA based on the directional distance function approach. One of the important issues in evaluating the efficiency of banks is to consider economic indicators. Because these indicators are very important for the bank's senior managers. In this paper, we present another model to evaluate the performance of banks based on the concept of cost efficiency. This model is introduced for two-stage network structure in DEA. The model takes into account the importance of inputs and outputs relative to each other based on the opinion of bank managers in the cost efficiency evaluation process based on the production trade-offs.

It can be said that the main contribution of this paper is as follows. In this paper, we propose bank performance evaluation models based on the two-stage network structure and concepts of technical and cost efficiency in DEA. The models consider the relationships of production trade-offs to apply the importance of each of the inputs, intermediate measures and outputs relative to each other in the performance evaluation process of banks. The models provide efficiency scores and efficient targets corresponding to inefficient banks.

The continuation of this paper is organized as follows. In the section 2, we present the methodology of the research, in the section 3, we use the proposed approach in this paper to evaluate a set of commercial banks in Iran. In the section 4, we present the results of the paper.

Literature Review

In this section, we examine some of the studies conducted in the fields in the field banking efficiency in DEA. There is an increasing number of studies to comprehensively examine the performance in the banking industry. Studies can be mainly divided into three streams: efficiency analysis (Tan and Floros, 2018, Fukuyama and Tan, 2022a, b), focusing on profitability analysis (Fang et al., 2019) and sustainability analysis (Tan et al. 2017). These three streams of study are in line with the three topics including bank profitability, cost management and stability in the banking industry. Fukuyama and Matousek (2011) developed a two-stage DEA model to obtain cost, technical, and allocative efficiency in the Turkish banking industry. Wanke and Barros (2014) applied a two-stage DEA model for measuring efficiency in the Brazilian banking industry. Wang et al. (2014) proposed a two-stage DEA network model that divided the production process into deposit production and profit earning. Fixed assets and labor were applied to create bank deposits in the first stage, and in the second stage, desirable and undesirable outputs were produced. An et al. (2015) proposed a two-stage DEA model present undesirable output for measuring slacks-based efficiency for commercial banks in China. Wanke et al. (2016) assessed productive efficiency of banks using integrated Fuzzy-DEA and bootstrapping. They applied their approach for Mozambican banks. Fukuyama and Matousek (2017) proposed a two-stage network DEA model for evaluating cost and revenue efficiency in Japanese banking industry. Wanke et al. (2018) proposed a comparison between stochastic DEA and fuzzy DEA approaches and revisiting efficiency in Angolan banks. Izadikhah et al. (2018) proposed a two-stage network DEA model. They divided each DMU into two sub-DMUs. Their model allows partial consumption of the sub-DMU's intermediate measurement in stage one by the sub-DMU in stage two and benefits from the advantage of assigning the initial input to one of the two sub-DMUs. Zhou et al. (2019) developed a multi-period three-stage DEA model for evaluating efficiency evaluation of banking systems under uncertainty. Konara et

al. (2019) evaluate the efficiency of banks for eight emerging market economies by using DEA models. Henriques et al. (2020) proposed a systematic review of the literature on the topic focusing on the banking industry. They analyzed 59 articles and divided them into ten classes covering different perspectives of two-stage DEA studies, such as economic context, geographical area of banking units, methodological characteristics and type of models, internal or external. Liu et al. (2020) proposed a new technological heterogeneity and target setting of intermediate output. They applied their approach to performance analysis of Chinese commercial banks. Xu and Zhou (2021) proposed a two-stage AR-DEA model to assess the efficiency of financial supply chain in Chinese commercial banks. Fukuyama and Tan (2022) presented a three-stage network DEA model. They estimated three different types of efficiencies, contains input efficiency, stability efficiency and output efficiency, they applied their model for measuring efficiency of banks in japan. Wanke et al. (2023) developed a new stochastic multi-criteria decision making to evaluate the performance of the Asian banking industry based on the sign decomposition. Fukuyama et al. (2023) proposed a dynamic network DEA with a sequential structure and behavioral-causal analysis. They applied approach in the Chinese banking industry. Kraidi et al. (2024) proposed a weight-restricted approach on constant returns to scale DEA models. They investigated efficiency of internet banking in Turkey.

Preliminaries

In this section, we consider the two-stage process in which each DMU consume only the inputs from the first stage to product the final outputs in the second stage via intermediate measures. Assume, we have n DMUs with a two-stage network structure as Figure 1.
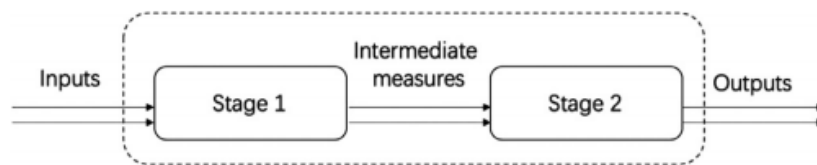

Figure 1. *Two-stage network system*

Let we have n DMUs as $DMU_j = (X_j, Z_j, Y_j)$, $j = 1, \dots, n$ in the productions process as in Figure 1. Assume the input vector from the first stage corresponds to DMU_j, $j = 1, \dots, n$ is as $X_j = (x_{1j}, \dots, x_{mj})$. The vector $Z_j = (z_{1j}, \dots, z_{Dj})$ is intermediate products, furthermore, the intermediate products are the outputs of stage 1 as well as the inputs of stage 2. The output vector of the second stage is $Y_j = (y_{1j}, \dots, y_{sj})$.

Consider T judgements judgement production trade-offs as

$$(M_t^1, N_t^1, M_t^2, N_t^2), \qquad t = 1, \dots, K. \quad (1)$$

We consider the vectors M_t^1, N_t^1 modify the inputs and intermediate products of production unit in the stage 1 respectively. Also, the vectors M_t^2, N_t^2 modify the intermediate products and outputs of production unit in the stage 2 respectively. Assume $\in R_+^m$, $W^1 \in R_+^D$ are the weight vectors correspond to the components of input and intermediate products in the stage 1 respectively. Also, $W^2 \in R_+^D$, $U \in R_+^s$ are the weight vectors correspond to the components of intermediate products and output in the stage 2 respectively. The corresponding weight restrictions on inputs, intermediate products and output, as follows.

Stage 1: $W_1^T M_t^1 - V^T N_t^1 \leq 0, \ t = 1, \dots, K,$ (4)

Stage 2: $U^T M_t^2 - W_2^T N_t^2 \leq 0, \ t = 1, \dots, K,$ (5)

We consider the vectors $M_t^1, N_t^1, M_t^2, N_t^2$ non-zero, then productions trade-offs are linked homogenous.

In this part, we propose the input-oriented envelopment two stage network DEA model with production trade-offs of inputs, intermediate measures and outputs for

measuring the technical efficiency score of $DMU_o = (X_o, Z_o, Y_o)$ as under evaluation DMU as follows.

$$\min\ \theta_{TR}$$
$$s.t.\ \sum_{j=1}^{n} \lambda_j x_{ij} + \sum_{t=1}^{K} \pi_{it}^1 N_{it}^1 + q_i^1 \leq \theta_{TR}\, x_{io},\ i = 1, \dots, m,$$
$$\sum_{j=1}^{n} \lambda_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^1 M_{dt}^1 \geq \theta_{TR}^2 z_{do},\ \ d = 1, \dots, D,$$
$$\sum_{j=1}^{n} \mu_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^2 N_{dt}^2 + q_d^2 \leq \theta_{TR}^2 z_{do},\ d = 1, \dots, D,$$
$$\sum_{j=1}^{n} \mu_j y_{rj} + \sum_{t=1}^{K} \pi_{it}^2 M_{dt}^2 \geq y_{ro},\ \ r = 1, \dots, s,\ \ \ \ \ (6)$$
$$\sum_{j=1}^{n} \lambda_j = 1,\ \lambda_j \geq 0, j = 1, \dots, n,$$
$$\sum_{j=1}^{n} \mu_j = 1,\ \mu_j \geq 0, j = 1, \dots, n,$$
$$\sum_{j=1}^{n} \lambda_j x_{ij} + \sum_{t=1}^{K} \pi_{it}^1 N_{it}^1 + q_i^1 \geq 0,\ i = 1, \dots, m,$$
$$\sum_{j=1}^{n} \mu_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^2 N_{dt}^2 + q_d^2 \geq 0, d = 1, \dots, D,$$
$$\pi_{it}^1, \pi_{it}^2 \geq 0,\ i = 1, \dots, m,\ t = 1, \dots, K,$$
$$q_i^1, q_d^2 \geq 0,\ i = 1, \dots, m,\ d = 1, \dots, D.$$

In model (6) λ_j and μ_j are intensity vectors corresponding to DMU_j, $j = 1, \dots, n$. θ_{TR} and θ_{TR}^2 are contraction variables in the whole process and stage 2 respectively.

In model (6), the expressions $\sum_{j=}^{n} \lambda_j X_j$ and $\sum_{j=}^{n} \lambda_j Z_j$ show an arbitrary DMU in production technology under variable returns to scale (VRS) technology. The expressions $\sum_{t=1}^{K} \pi_t^1 N_t^1$ and $\sum_{t=1}^{K} \pi_t^1 M_t^1$ modify this DMU by using production trade-offs (M_t^1, N_t^1), $t = 1, \dots, K$ in some proportions $\pi_t^1 \geq 0$ in the stage 1. Similarly, the expressions $\sum_{j=}^{n} \mu_j Z_j$ and $\sum_{j=}^{n} \mu_j Y_j$ show an arbitrary DMU in production technology under VRS technology. The expressions $\sum_{t=1}^{K} \pi_t^2 N_t^2$ and $\sum_{t=1}^{K} \pi_t^2 M_t^2$ modify this DMU by using production trade-offs (M_t^2, N_t^2), $t = 1, \dots, K$ in some proportions $\pi_t^2 \geq 0$ in the stage 2. And in this way, a new DMU is created in the process. The resulting DMU changes by increasing its inputs and decreasing its outputs.

Suppose $\left(\lambda^*, \mu^*, \theta_{TO}^*, \theta_{TO}^{2*}, \pi_t^{1*}, \pi_t^{2*}, q^{1*}, q^{2*}\right)$ is an optimal solution obtained from model (6). In this case, we define the efficiency score of first stage as follows.

$$\theta_{TR}^{1*} = \frac{\theta_{TR}^*}{\theta_{TR}^{2*}}.$$

That it is equivalent to $\theta_{TR}^* = \theta_{TR}^{1*} \times \theta_{TR}^{2*}$.
In this case, θ_{TR}^*, θ_{TR}^{1*}, θ_{TR}^{2*} show the efficiency scores of two stage network DEA

in the overall, stage 1 and stage 2 respectively.

Definition 1. DMU_o is called (weakly) efficient in evaluation with model (1) if and only if $\theta_{TR}^* = 1$.

Definition 2. DMU_o is called (weakly) efficient in evaluation with model (1) in the first and second stages, respectively, if and only if $\theta_{TR}^{1*} = 1, \theta_{TR}^{2*} = 1$.

The frontier projection for $DMU_o = (X_o, Z_o, Y_o)$ based on model (6) was presented as $(\theta_{TR}^* X_o, \theta_{TR}^{2*} Z_o, Y_o)$. The efficient target (target operation point) corresponding to DMU_o is defined as follows.

$$\Big(\sum_{j=1}^{n} \lambda_j^* X_j + \sum_{t=1}^{K} \pi_t^{1*} N_t^1 +$$
$$q^{1*}, \sum_{j=1}^{n} \lambda_j^* z_j + \sum_{t=1}^{K} \pi_t^{1*} M_{dt}^1, \sum_{j=1}^{n} \mu_j^* z_j +$$
$$\sum_{t=1}^{K} \pi_t^{2*} N_t^2 + q^{2*}, \sum_{j=1}^{n} \mu_j^* Y_j +$$
$$\sum_{t=1}^{K} \pi_t^{2*} M_{dt}^2 \Big).$$

The cost efficiency models, we evaluated the capability of producing observed outputs for under evaluation DMU by considering its minimum cost. In this paper, in order to evaluate the performance of commercial banks, we use the concept of cost efficiency. We consider the situation where input, output data and their corresponding input prices are known exactly for each DMU. Let c_i be the price of input i. We can therefore formulate the cost minimization relational two stage network DEA model. Considering that the

studied banks have a two stage network structure, therefore, we use the cost efficiency evaluation models for the two-stage network structure in DEA. In order to include the opinion of the bank's senior managers in the evaluation process, we use the production trade-offs method described in the previous section in these models. Now we present

performance evaluation models of DMUs with a two-stage network structure in the presence of production trade-offs based on the concept of cost efficiency. We measure the cost efficiency score of $DMU_o = (X_o, Y_o)$ as under evaluation DMU with production trade-offs as follows.

$$\min \ \sum_{i=1}^{m} c_i x_i$$
$$\begin{aligned}
s.t. \ &\sum_{j=1}^{n} \lambda_j x_{ij} + \sum_{t=1}^{K} \pi_{it}^1 N_{it}^1 + q_i^1 \leq x_i, \ i = 1, \ldots, m, \\
&\sum_{j=1}^{n} \lambda_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^1 M_{dt}^1 \geq z_{do}, \ d = 1, \ldots, D, \\
&\sum_{j=1}^{n} \mu_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^2 N_{dt}^2 + q_d^2 \leq z_{do}, \ d = 1, \ldots, D, \\
&\sum_{j=1}^{n} \mu_j y_{rj} + \sum_{t=1}^{K} \pi_{it}^2 M_{dt}^2 \geq y_{ro}, \ r = 1, \ldots, s, \qquad (7) \\
&\sum_{j=1}^{n} \lambda_j = 1, \ \lambda_j \geq 0, j = 1, \ldots, n, \\
&\sum_{j=1}^{n} \mu_j = 1, \ \mu_j \geq 0, j = 1, \ldots, n, \\
&\sum_{j=1}^{n} \lambda_j x_{ij} + \sum_{t=1}^{K} \pi_{it}^1 N_{it}^1 + q_i^1 \geq 0, \ i = 1, \ldots, m, \\
&\sum_{j=1}^{n} \mu_j z_{dj} + \sum_{t=1}^{K} \pi_{it}^2 N_{dt}^2 + q_d^2 \geq 0, \ d = 1, \ldots, D, \\
&\pi_{it}^1, \pi_{it}^2 \geq 0, \ i = 1, \ldots, m, t = 1, \ldots, K, \\
&x_i \geq 0, q_i^1 \geq 0, q_d^2 \geq 0, \ i = 1, \ldots, m, d = 1, \ldots, D.
\end{aligned}$$

Let $X' = (x_1', \ldots, x_m')$ is the optimal solution of model (8). We measure the minimum production cost of DMU_o with production trade-offs as follows.

$$CE_{TO}^{Two-stage} = \frac{C^t X'}{C^t X_o} = \frac{\sum_{i=1}^{m} c_i x_i'}{\sum_{i=1}^{m} c_i x_{io}} \qquad (8)$$

Definition 3. The cost efficiency score with production trade-offs corresponding to $DMU_o = (X_o, Z_o, Y_o)$ is defined as the ratio of minimum cost to the actual cost namely $CE_{TO}^{Two-stage} = \frac{C^t X'}{C^t X_o} = \frac{\sum_{i=1}^{m} c_i x_i'}{\sum_{i=1}^{m} c_i x_{io}}$. If $CE_{TO}^{Two-stage} = 1$ then DMU_o is called DEA cost efficient with production trade-offs. Otherwise we call this DMU as DEA cost inefficient.

Suppose $\left(X', \lambda', \mu', \pi_t^{1'}, \pi_t^{2'}, q^{1'}, q^{2'}\right)$ is an optimal solution obtained from model (8). The cost efficient target operation point corresponding to DMU_o is defined as follows.
$$\left(\sum_{j=1}^{n} \lambda_j' X_j + \sum_{t=1}^{K} \pi_t^{1'} N_t^1 + d_1', \sum_{j=1}^{n} \mu_j' Y_j + \sum_{t=1}^{K} \pi_t^{2'} M_{dt}^2\right).$$
The cost efficiency $CE_{TO}^{Two-stage}$ of DMU_o is therefore the ratio of this minimum cost to the observed cost.

Application to banking industry

Banking industry is a set of activities in banking operations, including policymaking, planning, organization and implementation. In simple words, the management of equipping and allocating resources in the money market is called banking. Banks often do marketing to be successful in providing their services. But unfortunately, due to the lack of familiarity with bank marketing, they only use the traditional marketing trends in a completely scattered and unrelated manner with the main goal of the bank. The banking industry is very important in all countries because this institution provides financial support at the micro and macro levels of society. At the macro level, large national and government projects are supported by bank funds. At the micro level, the life of entrepreneurial companies depends on the financial resources of banks. A bank should react appropriately to evidence from marketing research. Marketing of banking services should be considered for success. Considering the importance of performance evaluation in the banking industry, in this study we will evaluate the performance of a group of banks in Iran. In this evaluation, we

have used the data set related to 26 branches of commercial banks in Iran. These banks operate in a competitive market. A commercial bank can generally be considered as a two-stage network system as shown in Figure. 1.

Each commercial bank branch is regarded as a two-stage system which contains the fund system and the profit-earning system.

In this evaluation we consider three inputs, two intermediate measures and three outputs.

Inputs include personnel expenses, interest expenses and non-interest expenses

Personnel expenses includes the costs that the bank pays for its personnel during this evaluation period. These costs include salaries, insurance, benefits and bonuses, overtime, insurance and medical treatment.

Interest expenses is the amount of interest paid to bank customers. Customers leave their deposits with the bank based on a specific contract. The bank receives interest for each deposit. The total amount paid to customers during the assessment period for these deposits is called net interest expense.

Non-interest expenses: These costs include costs that are not directly related to attracting and maintaining deposit funds. These costs include the bank's costs in various cases, including building rent, costs related to the maintenance of bank properties, current costs of the bank, costs of creating and maintaining software and hardware facilities, service costs such as water and electricity, gas, and energy costs.

Three final outputs were also considered in this evaluation. These **final outputs** include net interest income, non-interest income, and total deposits.

Net interest income: These incomes include the income that the bank earns from providing loan facilities to customers. This interest rate is determined by the bank based on this contract with customers. These incomes are the result of subtracting the total amount received from customers from the loan amount given to them. The total amount of net interest income for each of the banks is considered a desirable output. The bigger the

amount of these revenues, the more income the bank can earn.

Non-interest incomes: These incomes include bank incomes other than bank interest. These incomes include the income earned from customers from various services, including various fees, income from the transfer of various funds by customers, ATM machines, income from interbank transfers, income from Internet services, fees related to sending SMS to customers, etc.

Intermediate products are total deposits and other raised funds.

Total deposits: These deposits include current deposits, short-term deposits, and long-term deposits. The larger the total amount of deposits, the higher the liquidity of the bank, and the bank can pay facilities to its customers, and as a result, it can receive higher interest from the place of payment of facilities. The bank pays a small interest rate for short-term deposits but pays more interest for long-term deposits. But they do not pay interest on current deposits. The more time the deposits are available to the bank and the larger their amount, the greater the bank's liquidity will be, and the bank can pay facilities to its customers from the deposits and earn a larger profit from the interest on the facilities.

Other raised funds

Collected funds include deposits and other types of funds that are used at the end of the first period in the second period of banks' performance. In each bank, the main function of the fund system is to use personnel expenses, interest expenses and non-interest expenses to collect funds (including deposits and other types of funds) and total deposits while the profit-making system uses the funds generated total deposits and from the fund system to make a net interest income, non-interest income, and total deposits.

The evaluation period includes two six-month periods in 2023. that the information of the banks is included in the performance of the banks in the first six-month period as the

first stage and the second six-month period as the second stage. The unit of data measurement is **million tomans**.

We show two-stage structure of the banking system in Figure 2.

Figure 2. *Two-stage network system of each Bank branch*

Due to the insistence of the central bank management, we refrained from mentioning the names of these banks and only displayed the banks with numbers B01 to B26. We show, first intermediate measure and two

intermediate measure as Z1 and Z2 respectively and first output and two output as Y1 and Y2 respectively. The data of banks are in the Table 1.

Table 1.
The data set of banks.

Banks	I1	I2	I3	Z1	Z2	Y1	Y2
B01	706.11	4964.98	2295.47	84910.43	121397.35	3375.49	1823.66
B02	1163.53	6437.86	2397.95	125485.59	153598.42	3654.69	1354.86
B03	814.74	3594.34	1458.03	73688.18	87150.98	2026.87	881.29
B04	559.52	2113.61	918.15	41620.94	47256.73	1014.31	483.06
B05	191.49	581.74	559.54	20941.49	29024.25	1135.97	587.35
B06	61.07	301.35	119.78	4028.6	5107.74	167.79	51.97
B07	26.71	81.5	46.3	1446.43	1626.97	49.5	14.97
B08	1264.08	7776.84	4370.98	152217.1	203023.54	7509.36	3025.94
B09	1097.68	5509.15	3026.66	102269.66	145699.02	4581.77	2012.86
B10	428.72	1836.86	840.49	29504.74	39785.7	934.43	475.17
B11	328.16	1830.39	626.62	34519.17	41051.2	1010.68	437.62
B12	430.02	1605.51	694.01	29574.75	34585.62	703.43	444.92
B13	293.46	2218.46	1092.69	26800.74	40731.43	1599.64	923.2
B14	119.3	589.55	234.74	9522.36	11051.6	269.33	185.28
B15	764.14	2109.24	1661.71	34542.3	58787.21	2331.14	1159.57
B16	160.78	778.92	252.77	11894.47	13331.91	272.93	118.91
B17	923.73	4823.48	1588.27	93365.78	110188.5	2333.58	1204.25
B18	102.17	647.96	376.14	7668.84	11802.97	481.47	253.39
B19	206.56	668.69	428.55	13317.42	24474.01	844.28	405.4
B20	6481.54	21373.2	11362.32	434320.03	556800.72	14424.78	5180.93
B21	153.18	611.43	468.76	16561.85	28004.53	932.58	286.87
B22	9.7	59.66	25.04	1039.59	1450.69	35.34	8.82
B23	113.81	483.12	237.46	7836.36	9057.15	311.46	154.81
B24	14.88	91.2	34.41	1508.76	1850.82	45.78	14.43
B25	291.01	1332.09	689.56	25628.59	31293.41	676.68	379.66
B26	445.86	3421.65	997.06	59781.53	73048.58	1517.09	698.37

At first, we consider two different weight restrictions to solve models (6) and (7). We select production trade-offs matrixes $M_t^1, N_t^1, M_t^2, N_t^2$ as follows.

Production trade-offs 1: $N_1^1 = \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix}, M_1^1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix},$

$N_1^2 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, M_1^2 = \begin{pmatrix} 2 \\ 0 \end{pmatrix}.$

Then $i = 3, r = 2, d = 2, t = 1$.
The weight restriction corresponding to these matrixes on the components of inputs, intermediate products and output are as follows.
$2w_2 + w_1 - 1v_1 - 2v_3 \leq 0$.
$2u_1 - 1w_1 \leq 0$.

where u_1, u_2, w_1, w_2, v_1, v_2 and v_3 are weights corresponding to the components of inputs, intermediate products and output, respectively. In this weight restriction, the importance corresponding to the intermediate products and inputs is like this the sum of two times the second intermediate product and one time the first intermediate product is less than or equal to the sum of one time the firs input and two times the three input. Also, the importance corresponding to the outputs and intermediate products is like this two times the first output is less than or equal to one time the first intermediate product. In this way, the importance of inputs and outputs, according to the opinion of bank managers, is included in the technical and cost evaluation models. The results of models (6) are in the Tables 2 and 3.

According to Table 2, by considering trade-offs 1, in the stage 1, banks B05, B08, B17, B20, B21, B22 and B26 are technical efficient and the other banks are inefficient. in the stage 2, banks B07, B08, B13, B15, B18, B20 and B22 are technical efficient and the other banks are inefficient. Banks B08, B20 and B22 are only overall technical efficient banks. The corresponding ranking of banks based on their technical efficiency scores is given in parentheses in Table 2.

Table 2.
The technical efficiency scores with trade-offs 1

Banks	first stage	second stage	Overall
B01	0.9996(2)	0.907(2)	0.9067 (3)
B02	0.9737(5)	0.481(16)	0.4683(17)
B03	0.9626(7)	0.4466(19)	0.4299(20)
B04	0.8975(9)	0.4597(17)	0.4126(22)
B05	1(1)	0.9036(4)	0.9089(2)
B06	0.6948(19)	0.6277(9)	0.4361(19)
B07	0.8617(10)	1(1)	0.8617(5)
B08	1(1)	1(1)	1(1)
B09	0.973(6)	0.8638(6)	0.8405(7)
B10	0.7417(17)	0.5374(13)	0.3986(23)
B11	0.9792(4)	0.4813(15)	0.4713(16)
B12	0.8431(12)	0.5804(10)	0.4894(15)
B13	0.7867(15)	1(1)	0.7867(9)
B14	0.7856(16)	0.8049 (8)	0.6324(11)
B15	0.83(13)	1(1)	0.83(8)
B16	0.8516(11)	0.4548(18)	0.3873(24)
B17	1(1)	0.5649(11)	0.5666(13)
B18	0.6589(20)	1(1)	0.6589(10)
B19	0.9332(8)	0.906(3)	0.8455(6)
B20	1(1)	1(1)	1(1)
B21	1(1)	0.5327(14)	0.5505(14)
B22	1(1)	1(1)	1(1)
B23	0.7094(18)	0.8386(7)	0.5949(12)
B24	0.9829(3)	0.885(5)	0.8699(4)
B25	0.8062(14)	0.5514(12)	0.4446(18)
B26	1(1)	0.4247(20)	0.4292(21)

In the Figure 3, we compare the technical efficiency scores of banks based on the model (6), in the stage 1, stage 2 and overall with production trade-offs 1.
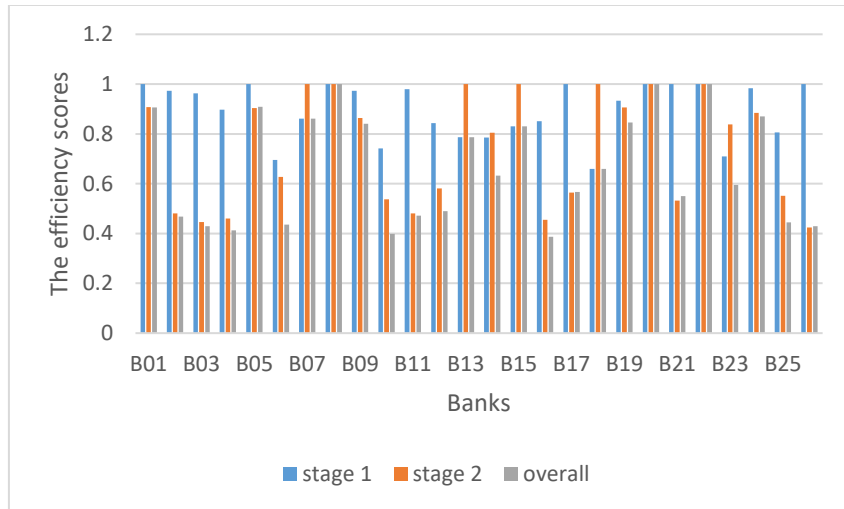
Figure 3. *The comparing the technical efficiency of banks*

The efficient targets (benchmarks or efficient operating points) corresponding to all banks are listed in Table 3. Inefficient banks should bring the level of inputs, intermediate measures and outputs to the level of their corresponding targets according to Table 3.

Table 3.
The technical efficient targets with trade-offs 1

Banks	I1	I2	I3	Z1	Z2	Y1	Y2
B01	640.2062	4464.117	2062.102	77015.05	110109.2	3375.49	1823.66
B02	544.9372	3015.16	1123.076	60357.52	73879.56	3654.69	1354.86
B03	320.4112	1545.187	626.7989	32908.93	38921.38	2026.87	881.29
B04	185.153	871.9798	378.7871	19131.63	21722.2	1014.31	483.06
B05	174.0461	528.7459	507.3028	18922.78	26226.39	1135.97	587.35
B06	24.2899	131.4266	52.2392	2528.782	3206.166	167.79	51.97
B07	15.3981	70.2266	39.8956	1446.43	1626.97	49.5	14.97
B08	1264.08	7776.84	4370.98	152217.1	203023.5	7509.36	3025.94
B09	922.626	4630.571	2543.979	88342.31	124731	4581.77	2012.86
B10	152.8688	732.1759	335.0209	15856.29	21381.44	934.43	475.17
B11	154.6731	862.726	295.3476	16615.55	19759.69	1010.68	437.62
B12	166.1528	785.6571	339.6141	17166.45	20074.97	703.43	444.92
B13	230.874	1268.776	685.8786	26800.74	40731.43	1599.64	923.2
B14	74.4255	372.8233	148.4463	7665.009	8895.968	269.33	185.28
B15	634.2563	1750.725	1345.144	34542.3	58787.21	2331.14	1159.57
B16	45.6944	301.6855	97.901	5409.497	6063.231	272.93	118.91
B17	518.8896	2733.143	899.9663	52737.82	62240.16	2333.58	1204.25
B18	67.3233	338.8879	190.3525	7668.84	11802.97	481.47	253.39
B19	123.6443	565.3483	362.3204	12065.25	18368.14	844.28	405.4
B20	6481.54	21373.2	11362.32	434320	556800.7	14424.78	5180.93
B21	84.333	336.6219	254.2746	8822.745	13248.94	932.58	286.87
B22	9.7	59.66	25.04	1039.59	1450.69	35.34	8.82
B23	62.7269	287.4292	141.2753	6571.704	7595.479	311.46	154.81
B24	11.8949	76.5789	29.9316	1335.204	1637.915	45.78	14.43
B25	129.376	592.2149	306.5617	14132.64	17256.45	676.68	379.66
B26	190.4813	1453.15	427.9265	25387.17	31021.24	1517.09	698.37

Now we determine the price of inputs in measuring cost efficiency. At first, to determine the first input price, i.e. the personnel expenses, it is calculated by

dividing the average salary and weekly benefits of that bank's employees by a 40-hour work week. This information is obtained from the statistics and informatics department of that bank. This price was equal to **10** million Tomans.

As can be seen, interest expenses are the expenses incurred by the bank for borrowed funds and represents the expenses payable for deposits and other borrowed funds. Therefore, interest expenses are related to the attraction and maintenance of depositor's funds. To determine the price of interest expenses in this study, we divide the total interest paid to bank customers for deposits during the evaluation period by the total number of customers. This price was equal to **7** million Tomans.

Also non-interest expenses represent the operational expenses of the bank, the expenses of converting deposits into loans. Non-interest expenses include all operational and overhead expenses of the bank, such as benefits, professional and administrative services, equipment and other expenses. In order to determine the price of inputs in measuring cost efficiency, in order to determine the price of non-interest expenses in this study, we divide the total cost incurred by this bank for building rent, bank property

maintenance, bank current, creating and maintaining software and hardware facilities, energy by the period of 12 months. This price was set at 5 million Tomans.

Now, in order to evaluate the cost efficiency of banks, we solve model (7). Considering the production trade-offs on input, intermediate measures and outputs, the manager's opinion can be included in the cost efficiency evaluation process of banks. The results of model (7) are shown in Table 4.

Due to the importance of inputs, we use models in the input oriented in this evaluation. The results are given in the Table 4. The second, third and fourth columns of Table 4 show the optimal level of inputs based on the cost efficiency model corresponding to banks. The optimal input level indicates the amount of specific input to the units in order to reach the cost efficiency level of the banks. The fifth and the sixth columns contain the total cost observed and the total minimum cost assigned to the bank in the cost efficiency evaluation process. The last column shows the cost efficiency scores. As can be seen banks B02, B05, B08, B20, B21, and B22 are cost efficient and other banks are cost inefficient under VRS technology.

Table 4.
The results of cost efficiency of banks with production trade-offs 1

Bank	Optimal inputs level			Total minimum cost	Total observed cost	Cost efficiency
B01	745.9732	4435.002	2551.044	51259.97	53293.31	0.9618(4)
B02	1163.53	6437.86	2397.95	68690.07	68690.07	1 (1)
B03	681.9232	3536.387	1487.092	39009.4	40597.93	0.9609(5)
B04	383.7653	1740.116	923.1885	20634.41	24981.22	0.826(9)
B05	191.49	581.74	559.54	8784.78	8784.78	1 (1)
B06	37.0025	138.0697	105.315	1863.089	3319.05	0.5613(20)
B07	13.4162	70.3325	35.9664	806.3215	1069.1	0.7542(11)
B08	1264.08	7776.84	4370.98	88933.58	88933.58	1(1)
B09	900.2235	5429.931	3092.874	62476.12	64674.15	0.966(3)
B10	266.4145	1056.391	757.8111	13847.94	21347.67	0.6487(15)
B11	317.7338	1342.304	798.3038	16564.99	19227.43	0.8615(8)
B12	271.7611	1065.339	711.356	13731.76	19008.82	0.7224(14)
B13	237.2827	1125.027	759.6167	14046.1	23927.27	0.587(18)
B14	87.1842	282.1857	252.8595	4111.439	6493.55	0.6332(16)
B15	348.5672	1871.696	1155.09	22362.99	30714.63	0.7281(13)
B16	108.8518	344.4125	316.5666	5082.238	8324.09	0.6105(17)
B17	864.8834	4638.644	1833.123	50284.95	50943.01	0.9871(2)

| Bank	Optimal inputs level			Total minimum cost	Total observed cost	Cost efficiency
B18	70.6456	267.0039	209.2887	3621.927	7438.12	0.4869(21)
B19	134.1033	538.0683	409.7643	7156.333	8889.18	0.8051(10)
B20	6481.54	21373.2	11362.32	271239.4	271239.4	1(1)
B21	153.18	611.43	468.76	8155.61	8155.61	1(1)
B22	9.7	59.66	25.04	639.82	639.82	1(1)
B23	71.7838	237.9574	207.579	3421.435	5707.24	0.5995(19)
B24	13.9855	71.9676	37.6404	831.8304	959.25	0.8672(7)
B25	235.0702	844.2916	641.9627	11470.56	15682.53	0.7314(12)
B26	552.6206	2757.395	1242.543	31040.69	33395.45	0.9295(6)
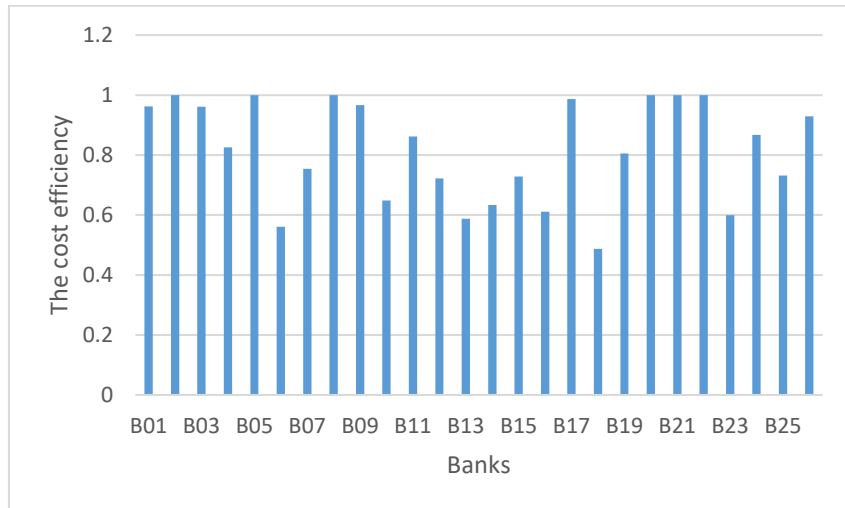
Figure 4. *The comparing the cost efficiency of bank*

In the Figure 4, we compare the cost efficiency scores of banks based on the model (7) with production trade-offs 1.

In order to sensitivity analysis of the results related to technical and cost efficiency measurement models namely models (6) and (7) to the change of production trade-offs matrices, we select production trade-offs matrixes $M_t^1, N_t^1, M_t^2, N_t^2$ as follows.

Production trade-offs 2: $N_1^1 = \begin{pmatrix} 1 \\ -0.8 \\ -0.7 \end{pmatrix}, M_1^1 = \begin{pmatrix} 1 \\ 7 \end{pmatrix},$

$N_1^2 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, M_1^2 = \begin{pmatrix} 2 \\ 0 \end{pmatrix}.$

Then $i = 3, r = 2, d = 2, t = 1$.

The weight restriction corresponding to these matrixes on the components of inputs, intermediate products and output are as follows.

$7w_2 + 1w_1 - 1v_1 + 0.8v_2 + 0.7v_3 \leq 0.$
$2u_1 - 1w_1 \leq 0.$

The results of model (6) and (7) by selecting production trade-offs 2 given in the Tables 5, 6 and 7.

Table 5.

The technical efficiency scores with trade-offs 2

Banks	first stage	second stage	Overall
B01	0.9996 (2)	0.907(2)	0.9067(3)
B02	0.9737(4)	0.481(17)	0.4683(15)
B03	0.9312(8)	0.4466(20)	0.4159(21)
B04	0.8425(10)	0.4597 (18)	0.3873(22)
B05	1 (1)	0.9036(4)	0.9078(2)
B06	0.6762(20)	0.6277(10)	0.4245(20)
B07	0.7856(15)	1(1)	0.7856(7)

Banks	first stage	second stage	Overall
B08	1(1)	1(1)	1(1)
B09	0.9524(7)	0.8638(6)	0.8227(5)
B10	0.7045(18)	0.5374(14)	0.3786(23)
B11	0.9681(5)	0.4813(16)	0.466(16)
B12	0.7883(11)	0.5804(11)	0.4576(17)
B13	0.7867(14)	1(1)	0.7867(6)
B14	0.7741(16)	0.8049(8)	0.6231(11)
B15	0.7517(17)	1(1)	0.7517(9)
B16	0.7951(13)	0.4548(19)	0.3616(24)
B17	0.989(3)	0.5649(12)	0.5586(13)
B18	0.6589(21)	1(1)	0.6589(10)
B19	0.856 (9)	0.906(3)	0.7755(8)
B20	1(1)	1(1)	1(1)
B21	1 (1)	0.5327(15)	0.5505(14)
B22	1(1)	1(1)	1(1)
B23	0.6922(19)	0.8386(7)	0.5805(12)
B24	0.964(6)	0.885(5)	0.8531(4)
B25	0.8016(12)	0.5514(13)	0.442(18)
B26	1 (1)	0.4247(21)	0.4287(19)

According to Table 5, by considering trade-offs 2, in the stage 1, banks B05, B08, B20, B21, B22 and B26 are technical efficient and the other banks are inefficient. In the stage 2, Banks B07, B08, B13, B15, B18, B20 and B22 are technical efficient and the other banks are inefficient. Banks B08, B20 and B22 are only overall technical efficient banks. The corresponding ranking of banks based on their technical efficiency scores is given in parentheses in Table 5.

Table 6.
The technical efficient targets with trade-offs 2

Banks	I1	I2	I3	Z1	Z2	Y1	Y2
B01	640.2062	4501.58	2081.225	77015.05	110109.2	3375.49	1823.66
B02	544.9372	3015.16	1123.076	60357.52	73879.56	3654.69	1354.86
B03	338.8419	1494.849	606.3795	32908.93	38921.38	2026.87	881.29
B04	216.6859	818.5401	355.573	19131.63	21722.2	1014.31	483.06
B05	173.8415	528.1244	507.9705	18922.78	26226.39	1135.97	587.35
B06	25.9232	127.918	50.8446	2528.782	3206.166	167.79	51.97
B07	20.9824	64.0234	36.3716	1446.43	1626.97	49.5	14.97
B08	1264.08	7776.84	4370.98	152217.1	203023.5	7509.36	3025.94
B09	903.0818	4532.48	2490.09	88342.31	124731	4581.77	2012.86
B10	162.3112	695.426	318.2053	15856.29	21381.44	934.43	475.17
B11	152.9109	852.897	291.9827	16615.55	19759.69	1010.68	437.62
B12	196.7582	734.6106	317.5484	17166.45	20074.97	703.43	444.92
B13	230.874	1745.331	859.6527	26800.74	40731.43	1599.64	923.2
B14	74.3361	367.35	146.2671	7665.009	8895.968	269.33	185.28
B15	574.3722	1585.428	1249.038	34542.3	58787.21	2331.14	1159.57
B16	58.1366	281.6504	91.3993	5409.497	6063.231	272.93	118.91
B17	516.0257	2694.553	887.2594	52737.82	62240.16	2333.58	1204.25
B18	67.3233	426.9628	247.8514	7668.84	11802.97	481.47	253.39
B19	160.1824	518.5533	332.3304	12065.25	18368.14	844.28	405.4
B20	6481.54	21373.2	11362.32	434320	556800.7	14424.78	5180.93
B21	84.333	336.6219	258.0751	8822.745	13248.94	932.58	286.87
B22	9.7	59.66	25.04	1039.59	1450.69	35.34	8.82
B23	66.0671	280.4526	137.8463	6571.704	7595.479	311.46	154.81
B24	12.694	77.8017	29.3548	1335.204	1637.915	45.78	14.43
B25	128.6287	588.7943	304.791	14132.64	17256.45	676.68	379.66
B26	191.144	1466.891	427.4481	25387.17	31021.24	1517.09	698.37

Table 7
The results of cost efficiency of banks with production trade-offs 2

Bank	Optimal inputs level			Total minimum cost	Total observed cost	Cost efficiency
B01	3274.69	1990.691	0	46681.73	53293.31	0.8759(8)
B02	1163.53	6437.86	2397.95	68690.07	68690.07	1(1)
B03	681.9232	3536.387	1487.092	39009.4	40597.93	0.9609(4)
B04	383.7653	1740.116	923.1885	20634.41	24981.22	0.826(11)
B05	191.49	581.74	559.54	8784.78	8784.78	1(1)
B06	37.0025	138.0697	105.315	1863.089	3319.05	0.5613(21)
B07	13.4162	70.3325	35.9664	806.3215	1069.1	0.7542(12)
B08	4130.733	5566.59	1314.255	86844.73	88933.58	0.9765(3)
B09	3931.776	2523.759	0	56984.07	64674.15	0.8811(7)
B10	366.2043	979.2512	641.2464	13723.03	21347.67	0.6428(16)
B11	317.7338	1342.304	798.3038	16564.99	19227.43	0.8615(10)
B12	271.7611	1065.339	711.356	13731.76	19008.82	0.7224(14)
B13	1051.938	213.5533	78.7959	12408.23	23927.27	0.5186(22)
B14	87.1842	282.1857	252.8595	4111.439	6493.55	0.6332(18)
B15	1733.417	265.7516	0	19194.43	30714.63	0.6249(17)
B16	108.8518	344.4125	316.5666	5082.238	8324.09	0.6105(20)
B17	864.8834	4638.644	1833.123	50284.95	50943.01	0.9871(2)
B18	276.3195	61.735	51.9188	3454.934	7438.12	0.4645(23)
B19	629.3349	49.4734	0	6639.663	8889.18	0.7469(13)
B20	6481.54	21373.2	11362.32	271239.4	271239.4	1(1)
B21	765.8163	0	0.0059	7658.193	8155.61	0.939(5)
B22	9.7	59.66	25.04	639.82	639.82	1(1)
B23	71.7838	237.9574	207.579	3421.435	5707.24	0.5995(19)
B24	13.9855	71.9676	37.6404	831.8304	959.25	0.8672(9)
B25	235.0702	844.2916	641.9627	11470.56	15682.53	0.7314(15)
B26	552.6206	2757.395	1242.543	31040.69	33395.45	0.9295(6)

The last column of Table 7 shows the cost efficiency scores of model (7) by considering production trade-offs 2. As can be seen banks B02, B05, B20, and B22 are cost efficient and other banks are cost inefficient under VRS technology.

Conclusions and Future Research Directions

One of the ways to include the DM's preferred information in the performance evaluation process in DEA is the production trade-off method. In this method, we consider the importance of inputs and outputs relative to each other in the performance evaluation model. This degree of importance is determined by the DM. Banks are one of the most important and influential institutions in the economic system of a country. These institutions are related to different industries. Evaluating their performance is also important for economic managers. In this paper, we evaluated the efficiency score of banks based on the superior information of senior bank managers. In this regard, we used the of production trade-off method in order to apply the superiority of inputs and outputs in the evaluation process of banks. The considered structure is the two stage network structure in DEA. We presented models for evaluating the performance of banks based on the concepts of technical and cost efficiency. We obtained the ranking corresponding to the banks based on the efficiency scores. Also, in order to the sensitivity analysis of the results relative to the change of production trade-off matrixes, we selected these matrixes differently and obtained the results of technical and cost efficiency measurement models for these different choices. As future works, we can develop the models presented in this paper for other two-stage network structure to evaluate the performance of banks, and we can also obtain the models

presented for other methods of weight restrictions.

Availability of data
All data used in this paper are available per request.

Conflicts of Interest
The authors declare no conflict of interest.

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RESEARCH ARTICLE   **Open Access**

Presenting the Model of Intelligent Sales Management System in Metaverse

Mehdi Rastegar [1]

Abstract
The intelligent sales management system in Metaverse is the concept of performing sales operations, using smart contracts, machine learning, intelligent process automation and direct monitoring of all network members in Metaverse.The aim of the current research is to provide a model of intelligent sales management system in Metavers. In the qualitative research, the statistical population includes experts in the fields of business management and information management, and the sample size was calculated and carried out according to the theoretical saturation point of 14 people using the snowball sampling method. Data collection was done through semi-structured interviews with experts and analysis. Data were collected using open, central and selective coding method. The findings obtained in the qualitative research showed 112 codes, 29 concepts and 9 categories, which led to the presentation of an intelligent sales management system model in Metaverse.
This research led to the presentation of a new model of intelligent sales management system.
Keywords: Intelligent management system, Metaverse, Foundation data.

Introduction

Metaverse is a big digital currency technology that has gained a lot of popularity around the world today. Metaverse is a collection of every virtual world that is built with the help of blockchain technology (Bell et al., 2023). Metaverse is a safe investment and away from problems. Metaverse is a vast network of virtual worlds used by an unlimited number of users, which has created a greater demand for goods and services, thus creating jobs for developers. , it facilitates designers and making money from Metaverse (Jiang and Danish Shahab, 2023).In the process of buying and selling in Metaverse, possibilities such as safe transaction process, variety of currencies used, possibilities of monitoring the market and prices, and the possibility of negotiation for pricing have been provided.Metaverse is used as a security tool for online shopping, but it should be noted that this tool also has limitations (Chiehai and Shimol, 2023).Shopping in

Metaverse requires a valid bank account and a bank card connected to it. If you don't have this information, it isn't possible to use Metaverse for online shopping. Metaverse, like any other tool, has problems such as the possibility of system disruption, the invalidity of some stores; therefore, to ensure the security and validity of the store, it is better to study and check carefully before buying from them. Also, It is better to buy from reputable and well-known stores to minimize the possibility of causing problems in the purchase and avoid any fraud (Visnobuana, 2023).

Attracting customer trust in online sales can be considered one of the most difficult and, of course, the most important steps in setting up an online business in Metaverse. Despite the convenience and benefits of buying from an online store, the level of trust in online shopping is relatively low. To overcome this problem, it's necessary to observe the key points of building trust in

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sales. Despite the growing trend towards online sales, some customers may be skeptical about these sales due to their novelty. On the other hand, storing sales information digitally, while having countless advantages such as ease of access and lower cost, is still subject to the serious challenge of loss and damage to information. Incidents such as the failure of storage components cause the prepared contract texts to be invalid.

In this research, after studying domestic and foreign articles on the topic of intelligent sales in Metaverse, the following cases were identified as gaps in the research, which have not yet been discussed in that field or have been incompletely stated. The first thing identified as a gap in research, knowledge and information technology operations in Metaverse. It is the science of using programs, software and equipment to process, maintain, store, distribute, transmit and protect information and data in networks. A computer connected to each other in the metaverse space of knowledge is called information technology. Information technology automation is the process of creating software and systems to replace processes. It's repeatable and reduces manual intervention. Robotic process automation is a software technology that makes it easy to automate digital tasks. Office automation is also a computer-based information system that collects, stores, and distributes documents, electronic messages, and other administrative communication sheets among individuals, groups, and organizations. is in charge of work and organizations (Lee et al., 2023).The importance of the current research is in terms of the important and new dimensions and components that are considered in the conceptual model of this research. According to the review of internal and external articles and researches, they are either ignored or incompletely raised. This research is important for the reasons of introducing new variables as described below, which are not considered in other domestic and foreign articles. Since conducting this research in Dubai Metaverse

Holding can to a large extent solve the problem of lack of trust, the possibility of fraud, hacking of the sales contract and data theft during sales in Metaverse. It is also necessary. Using smart sales with smart contract components, smart process automation and machine learning can lead to organizational agility and competitive advantage in Metaverse. Some of the major advantages of an intelligent sales management system include security, low cost, high speed, and great variety. The aim of the current research is to present the model of intelligent sales management system in Metaverse, and what is the model of intelligent sales management system in Metaverse? It was raised as the main research question.

Literature Review and background

Metaverse is a compound word consisting of meta, which means beyond, meaning the world, and therefore we can translate this word beyond the world. The Metaverse project is a wide network of virtual environments that are always active and online, where people can use avatars. By themselves or with the help of augmented reality glasses, communicate with each other and the surrounding digital objects. In other words, it's a combination of virtual reality, multiplayer online game and web browsing (Visnobwana, 2023). The results of several decades of research have shown that the quality of online interactions improves by creating a sense of real presence in this space. This sense of presence is also created through virtual reality technologies such as head-mounted displays. The second important concept that makes Metaverse different from our current experience of the Internet is "interactivity". (Rodriguez and Peterson, 2024).Smart sales management system is very important for businesses. This method can help businesses improve customer satisfaction and increase sales. An intelligent sales management system is a process that uses data and technology to improve decision making and sales performance (Das Vedata, 2024). Intelligent sales management system

is the concept of performing sales operations on the blockchain platform, using smart contracts, machine learning, smart process automation and with direct monitoring of all network members.Intelligent sales management system can be defined as a data-based approach to sales (Fistas Lopez et al., 2024).

This approach uses data related to customers, market and industry to identify trends, predict customer behavior and make intelligent decisions. Today, smart selling has become a necessity for successful businesses in the metaverse. Businesses that use an intelligent sales management system can gain a competitive advantage in a competitive market (Kaur et al., 2024).Ramezani et al. (2022) believe that the metaverse or the outer world is the newest word and concept that has attracted and occupied the imagination of the global technology industry. Darabpour (2023) showed in their research that the links between the financial, virtual and physical worlds are more connected than ever. Shahabadi et al. (2023) investigated the opportunities of e-commerce in Metaverse in their own research. which is considered fundamental in terms of purpose. Rach (2023) believes that the effectiveness of advanced technologies has a positive impact on marketing and sales system automation.

Butcher et al. (2024) in their research investigated new digitalization strategies, intelligent sales and product service systems, and intelligent delivery.Biancozzi et al. (2024) believe that businesses should use a new and smart business model in their smart sales management system processes. In this context, smart startups are a successful example of smart business in sales and service provision due to the production of shared value. Festas Lopez et al. (2024) believe that the skill and ability of employees in using and applying digital technology will have a positive effect on the company's sales system.

Das Vedta (2024) examined the influence of habit variables and pleasurable motivation on customer behavioral intention and smart sales in passenger car dealerships in his research.

Research Methodology

In the qualitative research method, the goal is to identify, classify and extract concepts based on the study of texts or based on the views of experts. Therefore, the main tools of data collection in the qualitative research method are interviews or library studies.

The systematic approach of Strauss and Corbin has been used in this research. Database theorizing is based on structured approach based on 3 types of open, central and selective coding. In open coding, the main categories and themes around the studied phenomenon are identified. In focus coding, categories are systematically refined and linked with subcategories. Finally, through selective coding, the research paradigm model is presented. A paradigmatic model includes causal conditions, contextual conditions, intervening conditions, strategies, and consequences. The community of participants in the qualitative research method of this study included experts in the field of study in the fields of business management and information management. Theoretical saturation was used to determine the sample size. Theoretical saturation is a point in qualitative research that indicates the adequacy of the collected data for analysis and presentation of the final report. The theoretical saturation point deals with the repetition of data in research, and this repetition of data and the results obtained from it, in methodology, indicates the reliability of the research method. During the interview process, theoretical saturation was achieved in 14 people. The snowball sampling method was used to select the sample. In this method, the researcher took help from the sample members to know other sample people. In this method, first a qualified person who had scientific articles in the fields of metaverse, smart business, smart sales was identified and then he was strongly requested to introduce a similar person. The specifications of the sample were as described in Table No. 1:

Table 1.

Specifications of the sample of experts

Area of activity	years	gender	education	string	connoisseur	Area of activity	years	gender	education	string	connoisseur
Industry and university	24	woman	Ph.D	Information management	The eighth expert	Industry and university	14	man	Ph.D	Business management	The first expert
Industry and university	22	woman	Ph.D	Information management	The ninth expert	Industry and university	16	man	Ph.D	Business management	The second expert
Industry and university	19	man	Ph.D	Information management	Expert 10	Industry and university	24	woman	Ph.D	Business management	The third expert
Industry and university	21	man	Ph.D	Information management	The eleventh expert	Industry and university	19	man	Ph.D	Business management	The fourth expert
Industry and university	14	woman	Ph.D	Information management	The twelfth expert	Industry and university	16	man	Ph.D	Business management	The fifth expert
Industry and university	18	Man	Ph.D	Information management	Thirteenth expert	Industry and university	23	woman	Ph.D	Business management	The sixth expert
Industry and university	25	woman	Ph.D	Information management	The fourteenth expert	Industry and university	16	Man	Ph.D	Business management	The seventh expert

In general, qualitative research should be reliable so that it can finally show accuracy in the process and appropriateness in the final material. Goba and Lincoln have proposed four indicators to check the credibility of qualitative research, which shows the following steps of the credibility of this research.1. Acceptability: To evaluate this stage, the researcher studied the selected documents for almost 3 months, and during the research, there was continuous back and forth interaction between the data and analysis done by the researcher and the opinions of experts on the subject of the research.

Research Findings

After open coding, it's time for axial coding or second level coding. This process is used to communicate between categories and sub-categories and enables the emergence of a conceptual framework. It's created by using a special model or paradigm and by determining the causes, contexts, possibilities, bases, correlations, interactions, consequences. The following table shows the axial and selective coding.

Table 2.

Axial and selective coding.

experts	Concepts	Categories - sources	axis
1-4-6-8	Information technology knowledge	Information technology capabilities (Lee et al., 2023), (Senmart et al., 2024), (Zhan et al., 2024)	Antecedents
5-8-9-11	IT operations		
6-8-9-13	Information technology tools		
9-11-14	Social intelligence	Business intelligence (Bucher et al., 2024), (Biancozzi et al., 2024) (Kuba et al., 2024), (Qazinouri et al., 2024)	Antecedents
7-9-11	Strategic intelligence		

experts	Concepts	Categories - sources	axis
3-5-7	Digital marketing	Metaverse Marketing	Antecedents
2-6-8	Smart marketing	(Jiang Barrera and Denish Shah, 2023), (Abarkoh Larbi, 2024), (Aliyo and Kadiro, 2023) (Kumar et al., 2024), (Smail, 2024), (Hao and Liu, 2024), (Guda et al., 2024) (Abdul Khalil Wa, 2024), (Saputra et al., 2024)	
8-10-14	Augmented reality marketing		
3-5-7	Collaborative	Organizational culture	background
1-6-11	Stability and integrity	(Cuesta Valinio and colleagues, 2024), (Ehsan, 2024)	
4-6-8-10	Flexibility		
2-4-9-10	Human resources	Organizational resources	The interlopers
3-6-8	Financial resources	(Cheng et al., 2024), (Zahed and Nauman, 2024)	
9-10-12	Physical resources and services		

Table 3.

Axial and selective coding.

experts	Concepts	Categories	axis
12-14	Smart sales contract	Dermatavers intelligent sales management system	Central phenomenon
14	machine learning	(Kaur et al., 2024), (Fistas Lopez et al., 2024), (Das Vedta, 2024) (Rodriguez and Patterson, 2024), (Dovidi et al., 2024), (Cheng et al., 2024), (Antonino et al., 2024)), (Zirar et al., 2024), (Frau et al., 2024) (Fernandez et al., 2024), (Moderno et al., 2024), (Rach, 2023), (Mighty et al., 2024), (Chakraburty et al., 2023), (Lee et al., 2024), (Kamat et al., 2024)	
2-4-6-8	Intelligent process automation		
10-11-13	Strategic business alignment	Digital transformation in the company (Troisan et al., 2024), (Melleh et al., 2024)	Strategy
1-2-6-9	Infrastructure management		
11-12-14	User relationship management		
3-8-9-12	Quality of service	Sustainable competitive advantage (Al-Khatib and Valeri, 2024), (Lee et al., 2024), (Gomeztrogio et al., 2024)	Consequences
13	Product innovation		
14	Communication with the customer		
1-3-5	Superior performance		
3-5-6-9	Superior performance	Organizational agility (Motwani and Katatria, 2024), (Jamal et al., 2024), (Gholtom et al., 2024)	
1-3-4-6	Rapid adaptation of production/services		
5-7-8-11	Dealing with problems quickly		
4-7-9-11	Quick decisions		
9-11-13	Redesigning the organization		

The paradigmatic model represents the final result of qualitative analysis using the database method. In this model, the categories identified by axial coding and open coding were displayed in the form of a systematic pattern as described in Figure 1.
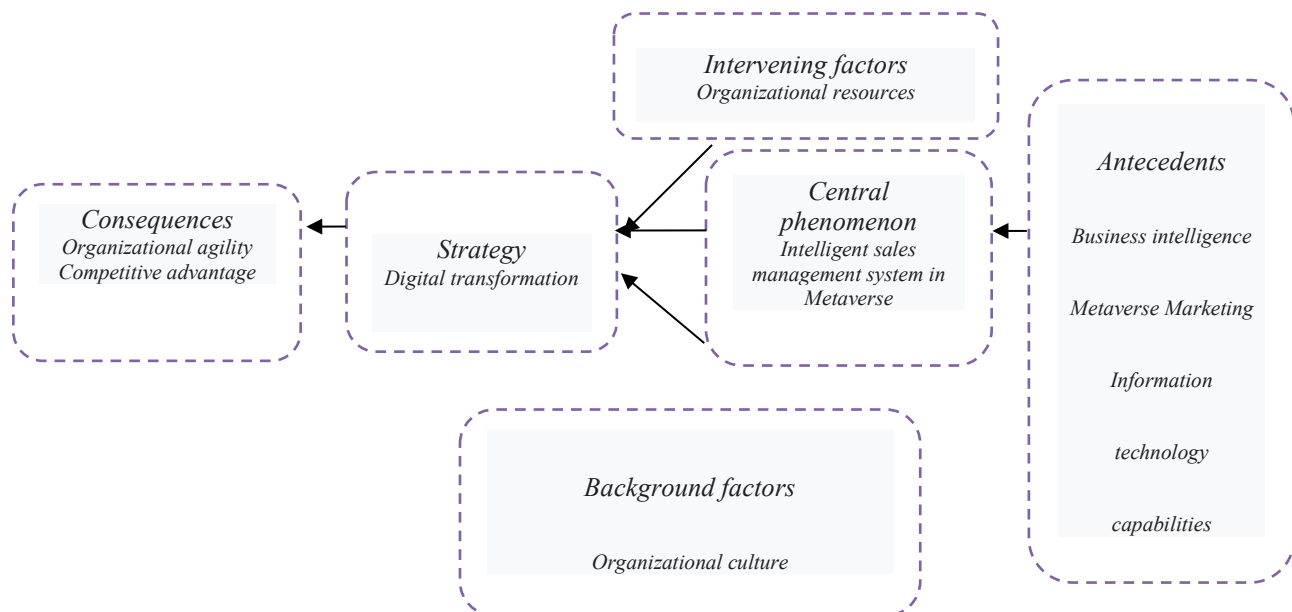

Figure 1. *Research paradigm model*

Discussion and Conclusion

The systematic approach of Strauss and Corbin has been used in this research. Database theorizing is based on structured approach based on 3 types of open, central and selective coding. The community of participants in the qualitative research method of this study included experts in the field of study in the fields of business management and information management. Theoretical saturation was used to determine the sample size. Theoretical saturation is a point in qualitative research that indicates the adequacy of the collected data for analysis and presentation of the final report. The point of theoretical saturation refers to the repetition of data in the research, and this repetition of data and the results obtained from it, in methodology, indicates the reliability of the research method. Theoretical saturation was achieved in conducting the interview process in 14 people. The snowball sampling method was used to select the sample. In this method, the researcher took help from the sample members to know other sample people. In this method, first a qualified person who had scientific articles in the fields of Metaverse, smart business, intelligent sales was identified and then he was strongly requested to introduce a similar person. After interviewing the sample, reaching theoretical saturation and data analysis, finally 112 open codes, 29 concepts and 9 categories were identified and finally a Paradigmatic model was drawn. Intelligent sales management system in Metaverse is one of the new methods of making foreign exchange income. Using the power of virtual reality, brands can create immersive experiences that engage and inspire customers, build stronger relationships, and increase sales. Businesses must use new and innovative methods to succeed in the competitive market. One of these methods is the intelligent sales management system. Markets are changing rapidly. Customers have new expectations and competitors are also innovating (Rodriguez and Peterson, 2024). Intelligent sales management system is the concept of performing sales operations on the blockchain platform, using smart contracts, machine learning, smart process

automation and with direct monitoring of all network members. (Fistas Lopez et al., 2024).

That can help businesses improve customer satisfaction and increase market share. (Das Vedta, 2024).Information technology capabilities are one of the antecedents influencing the intelligent sales management system in Metaverse. which is considered as a company's ability to use information technology resources in the entire company (Zhan et al., 2024). The ability of information technology is very effective on the company's conscious sales performance. These capabilities include three components of information technology knowledge, information technology operations, and information technology tools (Mao et al., 2020). Information technology knowledge refers to the science of using programs, software, and equipment to process, maintain, store, distribute, transmit, and protect information and data in connected computer networks.

Having a suitable infrastructure of information technology can affect the level of information technology knowledge in the field of intelligent sales. Information technology infrastructure is a set of hardware, software, network and services that are required to maintain, launch and manage a system. Information technology operations is another identified concept affecting the intelligent sales management system, which is the concept of processes and services that the company's sales and information technology employees provide to internal or external customers (Weded, 2023). Another identified concept is information technology tools.

Information technology includes a set of information tools, including remote communication tools, visual and audio tools, and related machines with knowledge, skills, and methods of using them in the production, processing, and documentation of information in order to transmit necessary and sufficient information in It's about the company's products to customers, which can affect the company's intelligent sales management system (Zhan et al., 2024).

Today, information is the main pillar of the company's power and information technology, a competitive tool and superior technology in the metaverse. By creating new and appropriate communication networks, information technology paves the way for easier mobility of technical, professional and financial services to customers. Therefore, the information technology capabilities of the company can be used to improve intelligent sales to target customers in Metaverse. Metaverse marketing is another identified precursor that includes digital marketing, smart marketing and augmented reality marketing (Abarkoh Larabi, 2024). Metaverse marketing refers to the use of virtual reality, augmented reality and other interesting technologies to promote products and services that are used in the virtual world with the aim of increasing sales or branding. (Saputra et al., 2024).Basically, digital marketing refers to all the things done in the marketing process, which are done on the internet and through channels such as social networks, search engines, e-mail and other things. These platforms can establish effective business communication with people and customers. Digital marketing actually focuses on technologies that focus on digitizing marketing processes and digital data processing (Saputra et al., 2024).Digital marketing, by using technologies that are referred to as interactive technologies, creates a peaceful and active relationship between customers and businesses in the metaverse environment. The result of which will be an increase in intelligent sales in the company. Smart marketing is another component of metaverse marketing. which is referred to as the intelligent use of equipment and information systems to facilitate marketing activities with the aim of making accurate and reliable decisions (Haw and Liu, 2024).

Augmented reality marketing is another component of Metaverse marketing that is used by companies to combine the real world with online advertising. This marketing method is used as an ideal way to convey persuasive messages to the audience. Augmented reality is an emerging trend in

marketing and sales strategies that allows brands to provide unique experiences to customers conveniently using mobile devices (Esmaeil, 2024).Augmented reality also works as a bridge between experience and action. Augmented reality can be used to provide a digital experience for promoting products and services in the metaverse. The customer's digital experience can be defined as the feeling of a customer from the package of his interactions with the organization in the digital environment (Kumar et al., 2024).In augmented reality marketing, users are allowed to see the products in their real environment virtually and view the product details before buying. As a result, this issue leads to increasing user confidence and reducing product returns. Augmented reality marketing can be a way to improve the shopping experience of Metaverse users. By using this technology, users can check the products in more detail and choose the best option. By using augmented reality, the user can see the products in the real environment with all the details, dimensions, colors along with other objects.Business intelligence is another effective precursor to intelligent sales management system in Metaverse. which consists of two components of social intelligence and strategic intelligence.

They do If the employees of the sales team have a high level of sales intelligence, they will be able to make the best use of the two characteristics of active listening and interpersonal cooperation in social interactions with customers in the virtual space and Metaverse, so that they can make effective sales (Shen et al. , 2022). Strategic intelligence also plays a very important role in strategic organizational decision-making and helps to improve the decision-making process of an organization in formulating sales policies and customer relations. This type of intelligence can help sales team employees to make their decisions based on detailed information about the characteristics, needs and behaviors of customers and make informed and intelligent sales (Rodriguez and Peterson, 2024).

According to the opinion of experts and the review of articles, Dermtavers intelligent sales management system was identified as a central phenomenon. An intelligent sales management system is a process that uses data and technology to improve decision making and sales performance (Das Vedata, 2024). The intelligent sales management system is the concept of performing sales operations on the blockchain platform with direct monitoring of all network members. which consists of three components of smart contract, machine learning and smart process automation (Fistas Lopez et al., 2024). Markets are changing rapidly. Customers have new expectations and competitors are also innovating (Rodriguez and Peterson, 2024).Accordingly, the intelligent sales management system will be very important for businesses. This method can help businesses improve customer satisfaction and increase sales. (Das Vedta, 2024).The smart sales contract is a program that can be stored on the blockchain and activated in some predetermined conditions (Antonino et al., 2024). These contracts are used to automatically execute the sales agreement. These contracts automatically activate the work process and when the conditions are met, the next activity starts (Frau et al., 2024).Intelligent process automation (IPA) is an efficient system that uses advanced technologies of artificial intelligence and data analysis to perform work processes automatically and intelligently. This system uses different artificial intelligence algorithms and models to recognize patterns, predict events, make decisions and implement appropriate actions with customers (Fernandez et al., 2024). Machine learning is also a type of artificial intelligence that provides the possibility of self-learning from sales data and then applies it to another task without the need for human intervention (Lee et al., 2024).In this research, digital transformation was considered as the strategy of intelligent sales management system in Metaverse, which consists of the components of strategic business alignment, technology infrastructure management and customer

relationship management (Lee et al., 2021). Digital transformation is the integration of digital technology into all areas of business, focused on changing the way operations are performed and delivering value to the customer. This integration causes fundamental changes in performance and the way of providing value to the customer.

Digital transformation eliminates the gap between the digital customer's expectations and the actual value delivered to him.Today, active businesses in the Metaverse use this strategy to improve productivity, control costs, and improve organizational values (May et al., 2024).One of the main benefits of digital transformation is the ability to track metrics and analyze data that is generated throughout the digital marketing process. Using the insights gained in this field allows businesses to optimize their strategies and processes and get better results. (Meleh et al., 2024).Competitive advantage is one of the other identified outcomes, which consists of the components of service quality, product innovation, customer relationship and superior efficiency. Competitive advantage is the value that a business offers to its customers. Value that includes services or attractions not offered by competitors. A loyal customer is formed because of competitive advantages (Hale and Jones, 2010).Competitive advantage has features such as durability, high defense capability, suitable tolerance, tolerance capability, high biological capability, high support capability, high acceptability, power of justification and proper persuasion, and considerable negotiation power. which, of course, according to the strength and stability of the competitive advantage, all or some of the above features will be present in it (Al-Khatib and Valery, 2024).Competitive advantage can be one of the most important factors in the long-term success of a business. When a business can perform better than its competitors, it is natural that the income and economic growth of this business can increase. This is because competitive advantage can bring in new customers, retain loyal customers, and find ways to serve target

markets and save costs, while also generating significant revenue (Gomeztrogio et al. , 2024). Organizational agility can reduce the time it takes to bring a new product to market. Productivity improvement coupled with a continuous improvement strategy helps businesses make the most of organizational agility to innovate, adapt, and implement improvements in their products and services. Modern consumers have high expectations.

The focus of organizational agility refers to the organization's ability to quickly adapt to new ideas, new technologies, changes and fluctuations in the business environment. The most important characteristic of an agile company is to pay attention to customer needs. The most important principle for the dynamism of a company is to be customer-oriented. Agile companies focus on customers and their needs. Every successful business knows when to be flexible and when to change its path to adapt to the force of external environments (Motwani and Katatria, 2024).Additionally, agile practices incorporate the ability to make internal changes to the business when necessary. At the heart of any agile business, customer focus, or placing customer needs and customer value, is a key priority. Companies that possess business agility are in a better position to attract new customers and retain existing customers, allowing their business to thrive. The ability to respond and react quickly and successfully to environmental changes is just one of the benefits of agility. Agility embraces aggressive and incremental change. (Galtoum et al., 2024).

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RESEARCH ARTICLE   **Open Access**

Explaining Brand Loyalty in B2B Models in Comparison with B2C

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Abstract

Within the realm of marketing literature, a prevailing notion posits that the strategies employed in marketing fundamentally diverge between business-to-business (B2B) and business-to-customer (B2C) models. This study delves into the realm of loyalty and undertakes an in-depth exploration of the nuanced distinctions in brand loyalty-building methodologies between B2B models and a spectrum of other business paradigms, with the ultimate goal of formulating an adept model tailored specifically for B2B enterprises. This research adopts a multifaceted, sequential exploratory mixed-methods approach. In its initial qualitative phase, it undertakes a systematic review coupled with meta-synthesis to discern the myriad factors influencing brand loyalty. Subsequently, in the quantitative phase, it employs sophisticated techniques such as structural equation modeling and path analysis to dissect and analyze the differential impact of various factors on brand loyalty across different business models. Finally, in its qualitative phase, the research incorporates insights gleaned from interviews to ascertain bespoke strategies conducive to fostering loyalty in B2B models. In the first stage and in the literature review, the data collection source will encompass all research conducted regarding the strategy implementation process from reputable domestic scholarly databases such as the comprehensive portal of humanities sciences, the academic Jihad portal, MagIran, as well as reputable foreign databases such as Scopus, Web of Science, approached with a systematic and saturation-based approach. The second phase will involve gathering information from various companies in the insurance industry, of varying sizes, operating under different business models (business-to-business and business-to-customer). Sampling will be conducted using the convenience sampling method and analyzed through structural equation modeling. The target population for the third phase will be business experts in business-to-business enterprises, selected using purposive judgment sampling and guided by the theoretical saturation criterion. The findings derived from the initial segment of the study unveil a comprehensive set of ten influential factors contributing to brand loyalty within B2B markets. These factors encompass a spectrum ranging from the satisfaction derived from the brand to the perceived value proposition, encompassing elements such as switching costs, trust, perceived quality, personalized interactions, perceived support and responsiveness, perceived value, perceived price and cost, brand image, and commitment. In the subsequent phase, the analysis unveils substantive disparities in the factors influencing brand loyalty between B2B and B2C models. Finally, the research elucidates a suite of tailored strategies essential for nurturing customer loyalty within the domain of B2B operations, including the formulation of clear strategic frameworks, delineation of stringent quality standards, harnessing technological advancements, perpetuating continuous market research endeavors, and.... This study goes beyond traditional limits by presenting a comprehensive overview of loyalty-building strategies across various business models, enriching the current understanding of this field. By utilizing insights from customer loyalty frameworks, the research leads to the creation of a customized loyalty model specifically tailored to meet the needs of the insurance industry. This provides professionals in the field with practical tools to improve their operational effectiveness and strengthen their competitive position.

Keywords: *B2B, B2C, Brand loyalty, Insurance industry*

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Introduction

In business-to-business (B2B) environments, the significance of customers is much more vital for companies than in consumer environments (Naidzayo et al., 2018). These environments provide different marketing conditions due to their unique characteristics and specific customers (business clients or organizational buyers). Such customers pay special attention to the quality of relationships with the counterpart organization due to the professional and measured nature of their interactions (Shoe-Hao et al., 2012). Consequently, attracting satisfaction and loyalty from business customers is a very complex, delicate, and time-consuming process for organizations, playing a crucial role in their success or failure (Palmer et al., 2020). Additionally, in B2B settings, producers, sellers, and marketers must pay attention to the specific characteristics of customers, who behave in measured and professional ways similar to organizations (Kiani, 2010). This is because organizational customers spend substantial amounts of money on products or services; therefore, managing and retaining loyal customers and developing relationships with them can create favorable opportunities for organizational profitability (Russo et al., 2016).

The importance of customer loyalty has expanded in recent years, and the most impactful research on this topic has been established in business-to-customer models, forming a foundation for scientific understanding of how brand loyalty methods are implemented. However, the question arises: how is the process of creating brand loyalty in B2B companies structured? Fewer studies have addressed this topic.

Despite the existence of studies that examine brand loyalty through B2B business models, our understanding of this important domain is relatively limited. Raiveren and Miller (2017) and Adjan and Clark (2019) explored how relationship quality impacts customer loyalty in B2B business models. Viswanathan et al. (2017) discussed social influence in loyalty within B2B models.

Naidzayo and colleagues (2018) examined the factors affecting brand loyalty within B2B business models, and Palmer and colleagues (2020) addressed the impact of commercial brand image on B2B relationships.

In marketing literature, there is an idea that marketing activities are fundamentally different in business-to-business models compared to business-to-consumer models. This research focuses on the topic of loyalty, examining the difference in brand loyalty methods between B2B business models and other various business models. The existing literature in this area largely assumes that the methods for fostering brand loyalty in B2B models differ, thus requiring alternative theories. However, to date, there has been no empirical research investigating these differences. Particularly, understanding how these differences relate to other business models, such as business-to-consumer and hybrid models, can facilitate planning for the B2B business model. Therefore, this research presents a broader perspective on the use of brand loyalty methods across a wider range of business models compared to existing studies, and, based on experiences from loyalty models in business-to-consumer settings, seeks to design a customer loyalty model in a business-to-business context, such as the insurance industry. Therefore, the main research question is: What are the factors influencing brand loyalty in the B2B model, and how do they differ from those in B2C models?

Theoretical Foundations and Research Background

Domestic research in the area of customer loyalty has primarily focused on business-to-consumer (B2C) models. For instance, Mizaei and Khademi (2020) examined the relationship between service quality and word-of-mouth marketing, with customer loyalty as a mediating factor, in the branches of Bank Tejarat in North Khorasan province. Rahimi and colleagues (2020) studied the impact of entrepreneurial marketing on brand equity and customer loyalty in sports organizations. Ahqaqi et al. (2020) identified

the ethical factors affecting customer loyalty models centered around brand personality. Dehdashti and colleagues (2019) proposed a model for customer engagement with brands on social media in the banking industry. Malekipour and Shadmehri (2019) investigated the furniture characteristics that influence customer loyalty in restaurants. Momenbarami and Jalali (2019) examined the impact of green marketing variables and customer loyalty, while Mohammadi et al. (2019) studied the effects of loyalty programs on customer loyalty in Asia Insurance. All these cases are focused on business-to-consumer models, and there is limited research regarding loyalty in business-to-business (B2B) models. The only research addressing this aspect is by Jafari Farsi and Zahidi (2016), who investigated the role of switching costs on customer loyalty in business relationships within industrial markets of the B2B business model.

In international research, Lucy and Morgan (2009) sought to discover the relationship between committed customers in B2B models and their willingness to support. Raiveren and colleagues (2009) conducted an empirical study expanding the fundamental knowledge of the relationship between service loyalty and brand equity performance outcomes in B2B businesses. Kater and Kater (2010) examined how product quality and relationships affect customer commitment, alongside their combined impact on loyalty in B2B contexts. Jantunen et al. (2011) stated that brand equity influences the loyalty objectives of B2B customers and that loyalty is neither a right of brand owners nor its outcome. Viswanathan et al. (2017) focused on social influence in adopting loyalty programs within B2B business models, highlighting the role of elite members. Naidzayo and colleagues (2018) showed that perceived franchise competence and information-sharing levels play crucial roles in emotional attachment to brands and perceived relational value, which, in turn, enhance brand loyalty. Adjan and Clark (2019) researched relationship quality in business-to-customer environments, with personality characteristics serving as moderating factors. Palmer and colleagues (2020) studied the role of brand image for relationships in logistics service providers within the B2B model in China. Yoo and colleagues (2021) examined the dimensions influencing mobile banking loyalty intentions and the reciprocal relationships affecting service quality and loyalty. Jedsada (2022) merged corporate community management, relationship marketing orientation, customer interaction, and brand trust to investigate brand loyalty in Thailand's banking industry.

While research on brand loyalty in business-to-consumer models is abundant, studies concerning other business models, especially B2B and hybrid models, are sparse, and our understanding of these important domains is relatively limited. These limited studies in the B2B business model have only addressed parts of the topic. In fact, comprehensive research in this area is lacking. Additionally, in marketing literature, there is a hypothesis that states: marketing activities are fundamentally different in business-to-business models compared to business-to-consumer models. The existing literature largely assumes that the methods for fostering brand loyalty in B2B models differ, indicating a need for alternative theories.

Research Methodology
This research employs a sequential exploratory mixed-methods approach, specifically a design tool (Creswell, 2012).
Phase 1. Qualitative Stage: In the first phase, a systematic review and meta-synthesis will identify the factors influencing brand loyalty.
Phase 2. Quantitative Stage: The second phase will utilize structural equation modeling and path analysis to examine the differences in business models regarding brand loyalty.
Phase 3. Qualitative Insights: In the third phase, qualitative interviews will be conducted to determine specific strategies for the business-to-business model.
Data Collection

Phase 1: The literature review will gather data from all relevant studies on strategy implementation from reputable domestic scientific databases such as the Comprehensive Human Sciences Portal, Jihad University Database, and MagIran, as well as international databases like Scopus and Web of Science. This will be conducted with a purposeful approach and theoretical saturation criteria.

Phase 2: Data will be collected from various companies in the insurance industry of different sizes, which operate under different business models (B2B and B2C). Sampling will be based on convenience sampling, and the data will be analyzed using structural equation modeling.

Phase 3: The target population for this phase will consist of experts from B2B businesses, sampled through a purposeful judgment approach, again using theoretical saturation criteria.

Research Findings

Phase 1. Findings (Qualitative): Identification of Factors Influencing Brand Loyalty

In this stage, the keywords "loyalty," "brand loyalty," and "services" were searched for the years 2007 to 2023. With these filters applied, a total of 147 relevant articles were identified from both databases. After screening, 94 articles of suitable quality were selected as final papers. The output from this screening was used to identify factors influencing brand loyalty in services. A coding method was applied to all identified articles, and the output is summarized in Table 1.

Table 1.
Output from the Qualitative Phase

Factors	Related Research Articles
Perceived Quality	Kiewitak et al. (2020); Neydazoa et al. (2016); Rayroun & Miller (2017); Yoo et al. (2021); Adjan & Clark (2019); Chent et al. (2010); Yalaber & Wirtz (2017); Izgu et al. (2015)
Satisfaction	Bidembach et al. (2015); Kessres et al. (2007); Han & Song (2008); Li et al. (2019); Lai et al. (2019); Bloemer et al. (1998); Kiyani (2011); Rayroun & Miller (2017); Shehzad et al. (2021)
Trust	Kessres et al. (2007); Han & Song (2008); Kofi Omakou et al. (2020); Hamidi Zadeh et al. (2011); Kiyani (2011); Rayroun & Miller (2017)
Commitment	Kessres et al. (2007); Kater et al. (2010); Han & Song (2008); Kofi Omakou et al. (2020)
Switching Costs	Bidembach et al. (2015); Han & Song (2008); Gicker et al. (2016), Hosseini, et al. (2024)
Perceived Value	Bloemer et al. (2011); Kater et al. (2009); Han & Song (2008); Janita & Miranda (2013); Neydazoa et al. (2016); Gicker et al. (2016); Jiawarthena (2010); Kofi Omakou et al.
Support and Responsiveness	Bloemer et al. (2011); Kater et al. (2009); Neydazoa et al. (2016); Naidzayo et al. (2018)
Personalized Interactions	Bloemer et al. (2011); Kater et al. (2009); Neydazoa et al. (2016); Hamidi Zadeh et al. (2011); Bloemer et al. (1999); Naidzayo et al. (2018) Nugroho, et al. (2015)
Brand Image	Yalaber & Wirtz (2017); Han & Song (2008); Janita & Miranda (2013); Gitiour & Jatarji (2020); Chanban et al. (2021); Lai et al. (2019); Balmer et al. (2020); Yalaber & Wirtz (2017); Gitiour & Jatarji (2020), Eghbali and Saeedi (2021),Rostami, et al. (2019)
Perceived Price and Costs	Kater et al. (2009); Gicker et al. (2016); Shehzad et al. (2021); Sweeney & Soutar (2001)
Empathy	Naidzayo et al. (2018); Bloemer et al. (1999)
Perceived Competence	Naidzayo et al. (2018), Falahatgar, et al. (2021)
Level of Information Sharing	Naidzayo et al. (2018)
Brand Association	Bidembach et al. (2015)

For finalizing the model, two indicators were used: Content Validity Ratio (CVR) and Content Validity Index (CVI). After removing three variables, the final conceptual model was formulated as follows. By reviewing the selected articles, a set of relationships among the variables was established, represented in figure 1. As indicated, the impact and relationships between the variables can be expressed through 23 hypotheses (Table 2).

Figure 1. *Conceptual model derived from the findings of the qualitative phase*

Table 2.
Research Hypotheses

Hypotheses	Related Research Articles
1. Relationship between perceived quality and loyalty	Bidembach et al. (2015); Yalaber & Wirtz (2017); Izgu et al. (2015); Janita & Miranda (2013); Kiewitak et al. (2020); Neydazoa et al. (2016)
2. Relationship between perceived quality and satisfaction	Chent et al. (2010); Yalaber & Wirtz (2017); Izgu et al. (2015); Janita & Miranda (2013); Jiawarthena (2010); Neydazoa et al. (2016); Lai et al. (2019); Bloemer et al. (1998); Moradi (2010)
3. Relationship between perceived quality and perceived value	Janita & Miranda (2013); Jiawarthena (2010); Lai et al. (2019)
4. Relationship between service quality and trust	Chent et al. (2010)
5. Relationship between satisfaction and brand loyalty	Bidembach et al. (2015); Bloemer et al. (2011); Kessres et al. (2007); Kater et al. (2009); Han & Song (2008); Janita & Miranda (2013); Jiawarthena (2010); Kofi Omakou et al. (2020)
6. Relationship between satisfaction and trust (and vice versa)	Kessres et al. (2007); Kofi Omakou et al. (2020); Mahdikhani (2015)
7. Relationship between satisfaction and commitment (and vice versa)	Kessres et al. (2007); Kofi Omakou et al. (2020)

Hypotheses	Related Research Articles
8. Relationship between trust and brand loyalty	Kessres et al. (2007); Han & Song (2008); Kofi Omakou et al. (2020); Hamidi Zadeh et al. (2011); Rayroun & Miller (2017)
9. Relationship between commitment and brand loyalty	Kessres et al. (2007); Kater et al. (2010); Han & Song (2008); Kofi Omakou et al. (2020)
10. Relationship between switching costs and brand loyalty	Bidembach et al. (2015); Han & Song (2008); Gicker et al. (2016)
11. Relationship between switching costs and satisfaction	Bidembach et al. (2015); Han & Song (2008)
12. Relationship between perceived value and satisfaction	Bloemer et al. (2011); Kater et al. (2009); Han & Song (2008); Janita & Miranda (2013); Neydazoa et al. (2016); Gicker et al. (2016)
13. Relationship between perceived value and loyalty	Jiawarthena (2010); Kofi Omakou et al. (2020); Neydazoa et al. (2016); Gicker et al. (2016)
14. Relationship between support and responsiveness and perceived value	Bloemer et al. (2011); Kater et al. (2009); Neydazoa et al. (2016); Naidzayo et al. (2018)
15. Relationship between support and responsiveness and satisfaction	Neydazoa et al. (2016)
16. Relationship between personalized interactions and brand image	Bloemer et al. (2011); Kater et al. (2009); Neydazoa et al. (2016)
17. Relationship between personalized interactions and satisfaction	Hamidi Zadeh et al. (2011); Bloemer et al. (1999)
18. Relationship between support and responsiveness and personalized interactions	Naidzayo et al. (2018)
19. Relationship between brand image and satisfaction	Kasaya et al. (2017); Yalaber & Wirtz (2017); Han & Song (2008); Janita & Miranda (2013); Gitiour & Jatarji (2020); Hamidi Zadeh et al. (2011); Rezai Klidbari et al. (

Phase 2. Findings (Qualitative): Comparing Business Model Loyalty

Sample Description

The statistical sample of this research comprised two groups:

Corporate Customers: This group included 196 insurance companies, categorized as follows:

48 companies with less than 5 years of experience

70 companies with 5 to 10 years of experience

53 companies with 10 to 15 years of experience

25 companies with more than 15 years of experience

Individual Customers: A total of 286 individual participants were surveyed, consisting of:

154 women

132 men

Statistical Analysis

The Kolmogorov-Smirnov test indicated that the significance levels for all variables were less than 0.05, suggesting that the

research data were not normally distributed. Therefore, structural equation modeling (SEM) using SmartPLS was employed.

As we aimed to examine the factors affecting brand loyalty in both B2B and B2C markets, a multi-group analysis method was utilized. To perform the multi-group analysis, a permutation test with the MICOM approach was conducted. This process follows three stages:

Configuration Invariance
Composite Invariance
Equality of Means and Variances

Based on the results of this process, comparisons between the two groups can be made. The model in Figure 2 illustrates the conceptual framework of this research.
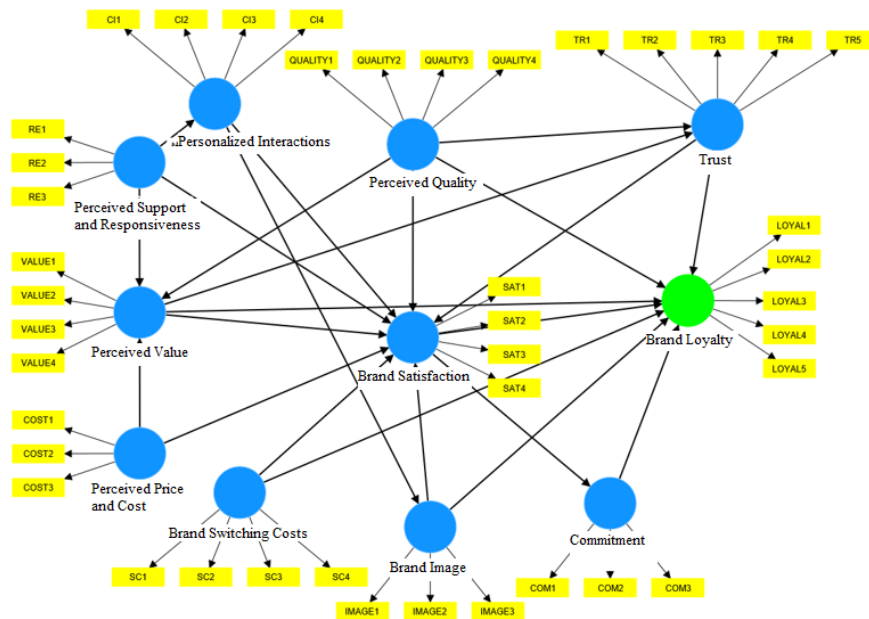
Figure 2. *Research Conceptual Model in Smart PLS*

Measurement Model Test
Reliability Assessment
For the measurement model test, we employed the following reliability indicators:
Factor Loadings
Cronbach's Alpha
Composite Reliability (CR)
Convergent Validity: Average Variance Extracted (AVE)
Discriminant Validity: Cross-loading matrix and the Fornell-Larcker criterion.
Factor loadings (Figure 3 and 4) are computed by examining the correlation of the indicators with their respective construct. If the loading value is equal to or greater than 0.4, the reliability of the measurement model is considered acceptable (Davari & Rezazadeh, 2017). It can be observed that the factor loading values for all items in both groups are higher than 0.4, indicating suitable values.

Internal Consistency
Internal consistency of the measurement models is evaluated using Cronbach's alpha. Values of 70% to 80% are acceptable, 80% to 90% are good, and above 90% are considered excellent (Hosseini & Yadollahi, 2013). The Cronbach's alpha values in both groups of study are above 70%, indicating internal consistency and adequate reliability.

Composite Reliability
In addition to Cronbach's alpha, Composite Reliability is also used to assess construct reliability (Wirtz et al., 1974). A value greater than 0.7 for each construct indicates adequate internal consistency of the measurement models (Davari & Rezazadeh, 2017). As shown in Table 5, the Composite Reliability values in both groups are above 0.7, confirming suitable reliability in the research.

Convergent Validity

Convergent validity is a criterion used to confirm the fitting of measurement models. Fornell and Larcker (1981) introduced the AVE criterion for measuring convergent validity, stating that the critical value for AVE should be above 0.5 (Davari & Rezazadeh, 2017). To establish convergent

validity, the following relationships must hold:

$CR > 0.7$

$CR > AVE$

$AVE > 0.5$

The results from this analysis help ensure the robustness and reliability of the measurement model in our study.
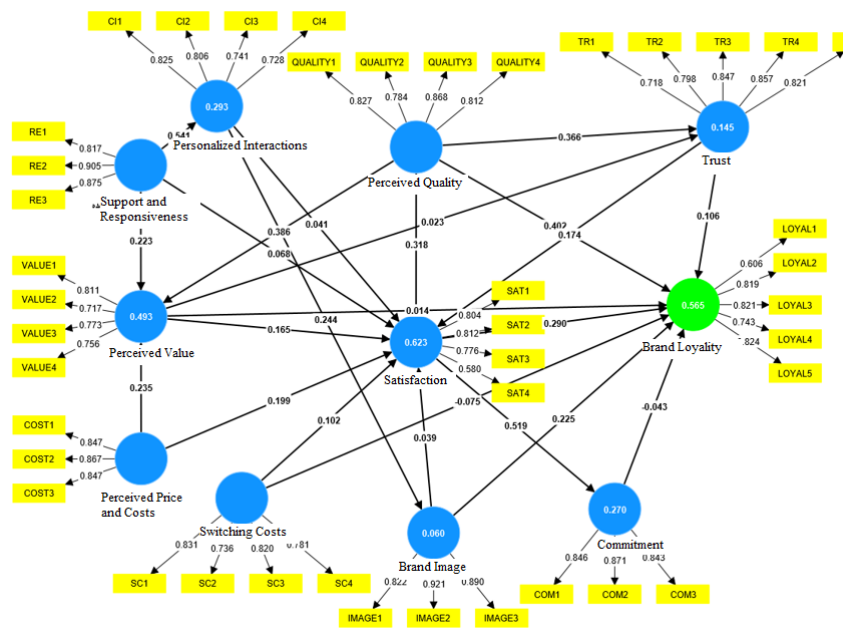
Figure 3. *Model Fit Results and Factor Loadings in the B2B Market*
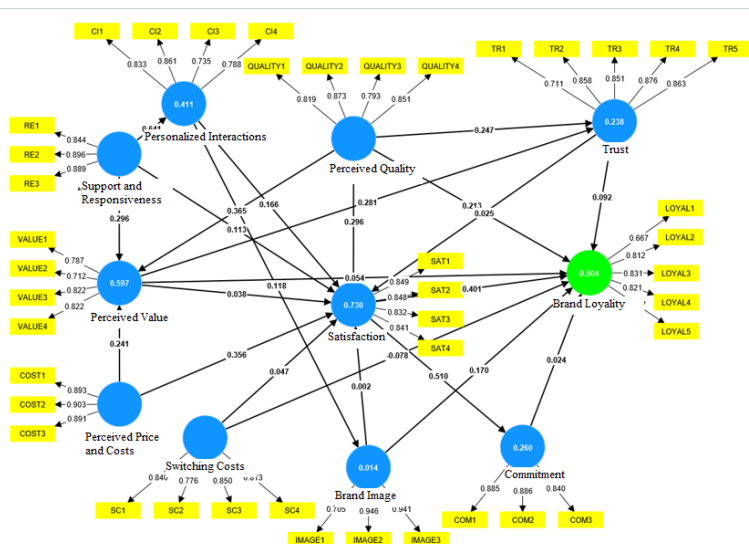
Figure 4. *Model Fit Results and Factor Loadings in the B2C Market*

As shown in the Table 3, the extracted mean variance values in both groups under investigation are higher than 0.5, and this mean value is greater than the value of composite reliability. Therefore, convergent validity in this research is acceptable for both groups studied.

Table 3.
Results of Reliability and Convergent Validity in the Two Groups Studied

Variable	B2B		B2C	
	Reliability	Convergent Validity	Reliability	Convergent Validity
	Composite Reliability	Cronbach's Alpha	Extracted Mean Variance	Composite Reliability
Perceived Value	0.849	0.763	0.866	0.795
Trust	0.905	0.870	0.919	0.892
Brand Image	0.910	0.854	0.903	0.860
Personalized Interactions	0.858	0.778	0.881	0.819
Commitment	0.890	0.814	0.904	0.841
Perceived Support and Responsiveness	0.900	0.837	0.909	0.850
Brand Satisfaction	0.834	0.734	0.907	0.864
Perceived Price and Cost	0.890	0.814	0.924	0.877
Brand Switching Costs	0.871	0.805	0.891	0.838
Brand Loyalty	0.876	0.823	0.897	0.856
Perceived Quality	0.894	0.841	0.902	0.855

Appropriate discriminant validity of a model indicates that a construct in the model interacts more with its own indicators than with other constructs. Discriminant validity is measured using the Fornell-Larcker matrix. As can be seen, all numbers on the main diagonal of the matrix are larger than their respective lower numbers, and discriminant validity for the research variables is confirmed in both groups studied (Table 4 and 5).

Table 4.
Discriminant Validity Results (Fornell-Larcker Matrix) in the B2B Market

Perceived Quality	Brand Loyalty	Brand Switching Costs	Perceived Price and Cost	Brand Satisfaction	Perceived Support and	Commitment	Personalized Interaction	Brand Image	Trust	Perceived Value	
										0.765	Perceived Value
									0.810	0.296	Trust
								0.879	0.160	0.198	Brand Image
							0.776	0.292	0.324	0.574	Personalized Interactions
						0.856	0.426	0.110	0.511	0.458	Commitment
					0.866	0.325	0.647	0.181	0.390	0.607	Perceived Support and Responsiveness
				0.749	0.603	0.668	0.603	0.252	0.572	0.803	Brand Satisfaction
			0.854	0.804	0.531	0.535	0.555	0.239	0.448	0.729	Perceived Price and Cost
		0.793	0.202	0.377	0.304	0.248	0.295	0.066	0.228	0.370	Brand Switching Costs
	0.767	0.162	0.639	0.789	0.471	0.399	0.499	0.473	0.452	0.554	Brand Loyalty
0.823	0.777	0.234	0.757	0.875	0.524	0.545	0.557	0.246	0.427	0.792	Perceived Quality

Table 5.
Discriminant Validity Results (Fornell-Larcker Matrix) in the B2C Market

Perceived Quality	Brand Loyalty	Brand Switching Costs	Perceived Price and Cost	Brand Satisfaction	Perceived Support and Responsiveness	Commitment	Personalized Interactions	Brand Image	Trust	Perceived Value	
										0.787	Perceived Value
									0.834	0.515	Trust
								0.871	0.190	0.137	Brand Image
							0.806	0.143	0.466	0.795	Personalized Interactions
						0.870	0.501	0.106	0.411	0.580	Commitment
					0.877	0.426	0.754	0.104	0.374	0.736	Perceived Support and Responsiveness
				0.843	0.695	0.590	0.781	0.131	0.489	0.813	Brand Satisfaction
			0.896	0.874	0.557	0.572	0.656	0.146	0.511	0.772	Perceived Price and Cost
		0.820	0.335	0.378	0.284	0.281	0.373	0.109	0.254	0.408	Brand Switching Costs
	0.798	0.175	0.662	0.746	0.553	0.456	0.564	0.290	0.448	0.611	Brand Loyalty
0.835	0.700	0.300	0.818	0.878	0.653	0.642	0.698	0.134	0.482	0.847	Perceived Quality

In the next step, the composite consistency among the constructs has been examined. In this step, composite consistency must be verified by creating equal composite scores in the two groups. For this purpose, permutation analysis was utilized in the software. The results obtained from composite consistency are shown in the table below. Given that the correlation between the composite scores using the weights obtained from both groups is close to one, it can be concluded that composite consistency exists in both groups (Table 6).

Table 6.
Results of Composite Consistency Measurement Using Permutation Test

Construct	Main Correlation	Average Permutation Correlation	5.0%	p-value	Partial Consistency Confirmation
Perceived Value	1.000	0.999	0.998	0.951	*
Trust	1.000	0.999	0.997	0.762	*
Brand Image	0.988	0.996	0.987	0.053	*
Personalized Interactions	0.999	0.999	0.998	0.413	*
Commitment	0.999	0.999	0.997	0.189	*
Perceived Support and Responsiveness	1.000	1.000	0.999	0.269	*
Brand Satisfaction	0.998	0.999	0.998	0.119	*
Perceived Price and Cost	1.000	1.000	0.999	0.843	*
Brand Switching Costs	1.000	0.995	0.984	0.953	*
Brand Loyalty	1.000	0.999	0.998	0.864	*
Perceived Quality	1.000	0.999	0.999	0.120	*

In the third step, the equality of means and variances of composite scores is examined (Table 7). Since the confidence intervals for the differences in means and variances of the construct scores between the two groups include zero, it can be concluded that the means and variances are equal, indicating complete measurement invariance. Therefore, based on the results presented, this three-step approach has been validated, and it is possible to assess the differences between the two groups.

Table 7.
Results of Mean and Variance Equality Using Permutation Test

Construct	Mean Equality		Variance Equality	
	Average Permutation Correlation	Permutation p-value	Average Permutation Correlation	Permutation p-value
Perceived Value	0.000	0.962	-0.079	0.576
Trust	0.001	0.999	-0.117	0.254
Brand Image	0.000	0.249	-0.093	0.283
Personalized Interactions	0.001	0.063	-0.042	0.728
Commitment	0.003	0.126	0.113	0.496
Perceived Support and Responsiveness	-0.003	0.199	-0.008	0.947
Brand Satisfaction	0.000	0.170	-0.289	0.036
Perceived Price and Cost	0.004	0.228	-0.187	0.137
Brand Switching Costs	0.000	0.655	-0.162	0.312
Brand Loyalty	0.000	0.810	-0.067	0.597
Perceived Quality	0.003	0.399	-0.025	0.861

Structural Model Test and Multigroup Analysis

In this stage, it is evaluated whether the relationships between constructs (structural coefficients) differ depending on the group. This analysis was conducted using Multigroup Analysis (MGA) with SmartPLS (Table 8).

Table 8.
Multigroup Analysis (B2B; B2C)

No.	Construct	Original (B2B)	Original (B2C)	t value (B2B)	t value (B2C)	p value (B2B)	p value (B2C)
1	Perceived Value -> Trust	0.023	0.281	0.269	3.581	0.394	0.000
2	Perceived Value -> Brand Satisfaction	0.165	0.038	2.510	0.638	0.006	0.262
3	Perceived Value -> Brand Loyalty	0.014	0.054	0.250	0.770	0.401	0.221
4	Trust -> Brand Satisfaction	0.174	0.025	3.135	0.624	0.001	0.266
5	Trust -> Brand Loyalty	0.106	0.092	1.979	1.842	0.024	0.033
6	Brand Image -> Brand Satisfaction	0.039	0.002	0.864	0.062	0.194	0.475
7	Brand Image -> Brand Loyalty	0.225	0.170	4.677	3.366	0.000	0.000
8	Personalized Interactions -> Brand Image	0.244	0.118	3.918	1.878	0.000	0.030
9	Personalized Interactions -> Brand Satisfaction	0.041	0.166	0.746	2.512	0.228	0.006
10	Commitment -> Brand Loyalty	-0.043	0.024	0.743	0.450	0.229	0.326
11	Perceived Support -> Perceived Value	0.223	0.296	3.864	5.367	0.000	0.000
12	Perceived Support -> Personalized Interactions	0.541	0.641	12.094	16.747	0.000	0.000
13	Perceived Support -> Brand Satisfaction	0.068	0.113	1.420	2.524	0.078	0.006
14	Brand Satisfaction -> Commitment	0.519	0.510	11.564	9.627	0.000	0.000
15	Brand Satisfaction -> Brand Loyalty	0.290	0.401	4.228	5.606	0.000	0.000

No.	Construct	Original (B2B)	Original (B2C)	t value (B2B)	t value (B2C)	p value (B2B)	p value (B2C)
16	Perceived Price -> Perceived Value	0.235	0.241	3.324	3.389	0.000	0.000
17	Perceived Price -> Brand Satisfaction	0.199	0.356	3.603	6.098	0.000	0.000
18	Brand Switching Costs -> Brand Satisfaction	0.102	0.047	2.660	1.043	0.004	0.148
19	Brand Switching Costs -> Brand Loyalty	-0.075	-0.078	1.629	1.708	0.052	0.044
20	Perceived Quality -> Perceived Value	0.386	0.365	5.404	4.921	0.000	0.000
21	Perceived Quality -> Trust	0.366	0.247	4.963	3.275	0.000	0.001
22	Perceived Quality -> Brand Satisfaction	0.318	0.296	4.596	4.973	0.000	0.000
23	Perceived Quality -> Brand Loyalty	0.402	0.213	6.430	2.555	0.000	0.005

Analysis of the Impact of Perceived Value on Trust in Two Groups

The analysis shows that the impact of perceived value on trust differs between the two groups studied. In the B2B group, this relationship was not confirmed, while in the B2C group, it was confirmed. Regarding the impact of perceived value on brand satisfaction, it was found that this effect was confirmed in the B2B group but not in the B2C group. The analysis of the impact of perceived value on brand loyalty revealed that this relationship was not confirmed in either group.

For the impact of trust on brand satisfaction, it was confirmed in the B2B group but not in the B2C group. The effect of trust on brand loyalty was confirmed in both groups. The analysis of the impact of brand image on brand satisfaction showed that this relationship was not confirmed in either market.

The results indicate that in both markets, the impact of brand image on brand loyalty and the impact of personalized interactions on brand image are significant, with the effect being stronger in the B2B market. The analysis of the impact of personalized interactions on brand satisfaction revealed that this relationship was not confirmed in the B2B group but was confirmed in the B2C group. The impact of commitment on brand loyalty was not confirmed in either group.

The results show that in both markets, the impact of perceived support and responsiveness on perceived value and the impact of perceived support and responsiveness on personalized interactions are significant, with the effect being stronger in the B2C market. The analysis of the impact of perceived support and responsiveness on brand satisfaction revealed that this relationship was not confirmed in the B2B group but was confirmed in the B2C group. In both markets, the impact of brand satisfaction on commitment is significant, with the effect being nearly equal in the B2B and B2C markets.

The results indicate that in both markets, the impact of brand satisfaction on brand loyalty is significant, with the effect being stronger in the B2C market. In both markets, the impact of perceived price and cost on perceived value is significant, with the effect being stronger in the B2C market. The impact of perceived price and cost on brand satisfaction is also significant in both markets, with the effect being stronger in the B2C market.

The analysis of the impact of brand switching costs on brand satisfaction showed that this relationship was confirmed in the B2B group but not in the B2C group. The impact of brand switching costs on brand loyalty was confirmed in the B2C group but not in the B2B group. In both markets, the impact of perceived quality on perceived

value is significant, with the effect being stronger in the B2B market. The impact of perceived quality on trust is significant in both markets, with the effect being stronger in the B2B market. The impact of perceived quality on brand satisfaction is also significant in both markets, with the effect being stronger in the B2B market. Finally, the impact of perceived quality on brand loyalty is significant in both markets, with the effect being stronger in the B2B market.

Phase 3. Findings (Qualitative): Strategies for Brand Loyalty in B2B Business Model

To present brand loyalty strategies in the B2B business model within the Iranian insurance industry, interviews were conducted with 15 industry experts. These semi-structured interviews were based on the results from the quantitative phase. Experts were asked to share their opinions on improving brand loyalty in the insurance industry. Below is an example of one of the interviews to illustrate how the results were obtained.

Interviewee: "Offering special discounts for loyal customers and creating a platform for rewarding companies that receive contracts with more services can increase the revenue of insurance companies and retain those customers."

From this interview, it was inferred that providing special discounts to customers based on the services received in their contracts can help improve customer loyalty. The results from the analysis of the interviews can be seen in Table 9.

Table 9.

Results from Expert Interviews on Strategies for Improving Brand Loyalty in Insurance

Main Category	Subcategory (Practical Strategies)
Clear Strategy Definition	Clear definition of relationship development strategies and service provision
Quality Standards Determination	Transferring quality standards to partners to prevent service delivery discrepancies. Establishing quality standards for professional and sustainable communications with companies
Use of Technology	Updating systems and using AI to improve service quality and online platforms for direct customer communication. Enhancing website and app focus on convenience and user-friendliness
Continuous Market Research	Conducting surveys and market research to better understand customer needs and preferences. Detailed analysis of customer data for performance improvement. Utilizing CRM tools for data analysis
Training and Skill Enhancement	Continuous training for employees to improve customer interaction and appreciation. Enhancing processes and improving efficiency to strengthen brand image and customer satisfaction. Developing training programs to enhance quality
Strengthening and Clarifying Communication	Focusing on one-on-one communication with customers. Competitive strategies based on price and performance, along with a focus on service quality and customer experience. Holding continuous dialogue and consultation sessions and workshops with company participation
After-Sales Service	Providing high-quality after-sales service to increase customer satisfaction
Discount and Reward Programs	Designing discount programs based on service quality in the market, such as volume discounts, discount coupons for occasions, etc.
Personalized Interactions	Utilizing digital technology for personalized experiences
Cost Calculation and Risk Management Platforms	Creating and updating cost calculation and risk management platforms and establishing installment insurance purchases
Time Management Programs	Designing time management programs and providing insurance services in the shortest possible time
Attention to Customer Feedback and Complaint Response	Promptly addressing and responding to customer complaints and flexibility in insurance conditions according to customer expectations
Non-Monetary Rewards	Offering non-monetary rewards such as free training, recognizing customers on special days, free consultations, and awarding certificates

Main Category	Subcategory (Practical Strategies)
Preferential Treatment	Providing preferential treatment to customers based on their different characteristics
Customer Club	Allocating benefits (exclusive services) to a group of customers in the form of customer club members

These findings highlight various strategies that can be implemented to enhance brand loyalty in the B2B insurance sector, focusing on customer engagement, service quality, and personalized experiences.

Discussion and Conclusion

This comprehensive study has made significant strides in understanding and modeling brand loyalty within the B2B market, specifically focusing on the Iranian insurance industry. By expanding upon existing frameworks and incorporating a broader range of dimensions and components, this research has developed a nuanced and localized model that addresses the unique dynamics of B2B brand loyalty in this sector. Key findings of this study underscore the critical importance of factors such as perceived quality, relationship satisfaction, trust, and commitment in fostering brand loyalty among B2B clients. These elements form the cornerstone of a robust loyalty framework that diverges significantly from traditional B2C models, highlighting the necessity for tailored approaches in B2B marketing strategies. The research provides valuable insights for insurance industry managers, offering concrete recommendations for enhancing brand loyalty in both B2B and B2C contexts. For B2B markets, the focus should be on developing competitive strategies that emphasize market pricing, performance metrics, and adherence to technical and legal specifications. Additionally, prioritizing service quality and overall customer experience is crucial in creating perceived value and solidifying brand loyalty.

Trust emerges as a universal factor influencing brand loyalty across both B2B and B2C environments. This finding underscores the importance of data-driven decision-making, where managers are encouraged to meticulously analyze customer data to identify opportunities for enhancing experiences and service delivery. In the B2C sector, the development of trust-building advertising campaigns and the refinement of customer service processes are recommended to foster positive customer experiences and effectively address complaints. While this study has made substantial contributions to the field, it also paves the way for future research directions. The exclusion of certain brand equity components, such as brand awareness and brand associations, during the expert opinion phase presents an opportunity for future studies to explore these elements and their impact on brand loyalty. Furthermore, comparative analyses across different industries could provide additional insights into the dynamics of brand loyalty, enabling practitioners to refine their approaches more effectively.

Comparison with Existing Research

In comparing these findings with existing literature, this study confirms and expands on previous research which established the significance of trust and perceived quality in fostering brand loyalty. For example, research conducted by Raiveren and Miller (2017) highlighted the role of relationship quality and its impact on customer loyalty within B2B models, aligning with this study's emphasis on trust and commitment.

Similarly, the findings resonate with Naidzayo et al. (2018), who identified the perceived value proposition as a critical driver of brand loyalty, a factor that is also present in this research's findings. Furthermore, the distinctions noted between B2B and B2C loyalty models enhance the discussions initiated by Viswanathan et al. (2017) regarding the unique characteristics of loyalty behaviors in different market contexts.

By integrating these insights into the conversation surrounding brand loyalty, this

research not only contributes to a deeper understanding of loyalty in B2B frameworks but also illustrates the varying dynamics that influence loyalty in diverse market segments, reinforcing the need for tailored strategies based on customer relationships and perceptions.

While this study has made substantial contributions to the field, it also paves the way for future research directions. The exclusion of certain brand equity components, such as brand awareness and brand associations, during the expert opinion phase presents an opportunity for future studies to explore these elements and their impact on brand loyalty. Furthermore, comparative analyses across different industries could provide additional insights into the dynamics of brand loyalty, enabling practitioners to refine their approaches more effectively.

In conclusion, this research not only advances the theoretical understanding of brand loyalty in B2B contexts but also offers practical, actionable guidance for enhancing marketing strategies within the Iranian insurance industry. By bridging the gap between academic research and industry practice, this study provides a valuable framework for future investigations and applications in B2B marketing strategies, ultimately contributing to the broader body of knowledge on brand loyalty and customer relationship management

Recommendations for Managers:

B2C Markets:

Focus on strengthening one-on-one communications with customers.

B2B Markets:

Develop competitive strategies based on market price, performance, and technical/legal characteristics.

Pay more attention to service quality and customer experience in creating perceived value.

Enhance brand image and customer satisfaction through process improvements and efficiency enhancements.

The results reveal that customer trust in a brand plays a vital role in fostering brand loyalty in both B2C and B2B markets. As a result, it is advisable for insurance managers to carefully examine customer data to pinpoint areas where customer experience or service delivery can be enhanced (Nugroho, et al. 2015). In B2C markets, managers should develop impactful advertising campaigns that prioritize building trust and promoting positive customer experiences. Additionally, they should refine customer service processes with an emphasis on resolving complaints and delivering high-quality service. Lastly, creating dedicated programs to collect customer feedback and swiftly implement necessary changes will further strengthen customer loyalty.

In this study, some dimensions of brand equity, such as perceived quality, were considered as influential factors on brand loyalty, while other dimensions were excluded during the expert opinion phase. Future research is suggested to explore additional components of brand equity, such as brand awareness and brand associations, to gain a broader understanding of the impact of brand equity on brand loyalty. Conducting comparative studies across different industries could yield valuable insights.

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RESEARCH ARTICLE　　　　　　　　　　　　　　**Open Access**

A Scientific Framework of Automated Accounting and Auditing on the Blockchain Technology Platform

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Abstract
The objective of this research is to contribute to the advancement of knowledge in the field of automated accounting and auditing, with a particular focus on the use of blockchain technology. Furthermore, the research will seek to establish a theoretical, conceptual and ethical framework for the aforementioned processes. This research employs a teleological approach, which is defined as a method of inquiry that seeks to identify the purpose or end result of a phenomenon. To this end, a systems approach in the modern approach of Future Technology Analysis (FTA) was used to examine the fundamental concepts underlying blockchain and its applications in accounting and auditing. The fundamental concepts underlying automated accounting and auditing on the blockchain platform were organized and explained within a scientific framework that includes theoretical, conceptual, and ethical considerations. Based on the aforementioned findings, a conceptual, theoretical, and ethical framework was developed and elucidated based on content analysis derived from an understanding of the essential elements of the topic, its underlying rationale, and its operational mechanics. This was accomplished through the use of coding in Atlas.ti v9 and ConceptDraw software. Blockchain capabilities provide a platform for automated accounting and auditing in a scientifically, practically, and logically rigorous manner. The evolution of this research was meticulously designed and presented as a conceptual, theoretical, and ethical framework. The features, alterations, and potentialities of automated accounting and auditing on the blockchain technology platform collectively reinforce the necessity for further investigation, as they demonstrate the significant advantages that this technology offers in comparison to traditional methods. This research takes a novel, forward-looking approach and envisions the use of automated accounting and auditing on the blockchain technology platform. It presents, for the first time, comprehensive scientific frameworks and a systematic model for integrating the understanding of concepts, foundations, processes, and norms.

Keywords: *Automated Accounting and Auditing, Blockchain, Theoretical Framework, Conceptual Framework, Ethical Framework.*

Introduction

The contemporary world is a field of profound change and accelerated dynamics that have brought the age of uncertainty to the fore. The ramifications of this uncertainty and the necessities that emerge from it are particularly relevant for those who create technology and digital solutions, which are rapidly expanding and encompassing an increasing number of scientific and practical domains. Abdoli et al., (2023) also state that in the world today, experts believe that

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planning and foresight are an inevitable necessity, which requires futurology.

The process of modernization requires the ability to identify emerging trends and to assess their potential implications. Consequently, a defining feature of modernity and postmodernity is the evolution of diverse theoretical frameworks within the pertinent discipline. This is due to the fact that the foundation of this era is the rejection of absolutism and esoteric theories. The application of efficacious, persuasive, and interdisciplinary perspectives, theories, and models, derived from the accumulated knowledge and insights pertaining to a subject, enables the investigation and recognition of the intricate and multifaceted aspects of a subject across diverse fields and its impact on ecosystems and the various actors within a network. Moreover, it provides the necessary mechanisms to facilitate the advancement of knowledge. Moreover, it provides a novel perspective on nascent trends and the fundamental principles of acceptance, enhancement, and evolution of the subject, which are essential for awareness and decision-making. In light of these considerations, it is evident that a robust knowledge base and scientific frameworks are necessary in these fields. Despite the plethora of theoretical advancements in financial reporting, accounting procedures persist in presenting a multitude of challenges and problems. In this context, technology, with its ongoing advancements, has emerged as a key solution to many of these challenges. Blockchain is currently one of the most significant technologies available, with the potential to address the fundamental issues currently facing accounting and auditing practices. As Fischer (2018) asserts, blockchain has the capacity to "solve the major problems of current accounting and auditing." Ahmadi et al., (2022) believe this technology increases productivity, speed, security and reduces costs in most operations, and as a result, it will significantly improve the quality of banks' services to end users.

The issues raised by this research contribute to the accumulation of knowledge

in this field and address a previously existing gap in the existing body of knowledge. To achieve this objective, a future-oriented technology analysis method was employed, which involved investigating and explaining the scientific framework (theoretical, conceptual, and ethical) of financial reporting according to the capabilities of the blockchain platform in the fields of accounting and auditing. This issue is aligned with the hypothesis of automated accounting and auditing on the blockchain platform, which is of significant interest for two reasons. Primarily, the subject under review is innovative. Secondly, it has international scope and the potential for scientific and practical applications.

Literature Review
Conceptual Foundations

The fields of accounting and auditing have undergone profound changes over the centuries, including not only changes in content and methodology, but also the advent of new technologies that have revolutionized the way information is processed in these fields. If we consider accounting and auditing standards as the primary driver of methodological, behavioral, and structural developments, as well as of content and information value, it becomes clear that the empirical knowledge supporting these developments is derived from the course of technical, economic, and social developments, as well as from globalization. The ideological foundation of accounting and auditing is based on subjective and experimental notions of explaining and transforming existing circumstances, as well as the politics of development and evolution. Needs and desires give rise to ideas, and gradual cognitive and experimental evolution in adaptation and response to environmental conditions and factors leads to the emergence of subsequent generations of accounting and auditing. In this phase of technological development, advancements and innovations driven by knowledge and experience play a pivotal role, as they have throughout the history of technology. This process requires a

comprehensive examination of historical data, an acute observation of the present circumstances, and a discernment of future projections. This has resulted in the advent of the mental, manual, mechanized, and soon-to-be-automatic generations in accounting and auditing. The advent of automated accounting and auditing represents a significant and ideal evolution and development in information systems, crediting, and reporting. This important development necessitates collaboration and solidarity with scientific and technical constructions, convergence, and synergy of information systems and new technologies, companionship and cooperation of the administrative system, alignment and agreement with laws and regulations, like-mindedness and conformity with accounting and auditing standards and principles, and alignment and similarity with the needs and wishes of the beneficiaries.

In essence, automated accounting and auditing is a process whereby a series of routine, stable, repeatable, and structured actions are performed, thanks to machine learning capabilities and new technologies. The application of machine learning allows accounting professionals to execute accounting and auditing procedures via software. The advent of new technologies has facilitated the automation of these processes to a significant extent, thereby reducing the dependence on manual inputs and human intervention. In consideration of the aforementioned factors, the definition of automatic accounting and auditing may be stated as follows: the performance of traditional accounting and auditing operations and techniques using technology in an online environment and without human intervention. In other words, the implementation of automated accounting and auditing procedures, coupled with the real-time identification, measurement, collection, recording, classification, summarization, analysis, reporting, and crediting of economic events and activities, enables the use of technology and adherence to established standards, principles, and regulations. This

approach aligns with the objective of facilitating informed decision-making among stakeholders and in the public interest.

The implementation of automated accounting and auditing processes has the potential to free the profession from the burden of tedious, time-consuming, voluminous, and error-prone tasks, including recording complex business transactions, tracking transactions and documentation, and preparing stressful and voluminous reports. Moreover, it augments the velocity, precision, and dependability of the reconciliation procedure by automating routine operations and high-volume transactions. The availability of standard frameworks and templates, coupled with customizable and compliant validation, provides an optimal strategy for low-risk automation.

The automating repetitive and simple tasks, accountants and auditors can be prepared and freer to face more complex issues. For example, data collection can be automated and then accountants will simply focus on data interpretation and implementation (Erickson, 2017). When accountants are not required to do manual entries, they can instead focus on analyzing statements and financial matters where accounting expertise is essential. Such analyses also enhance the quality of financial statements, thereby increasing reliability (Lupasc et al., 2012). If all components function as intended and concepts are designed in accordance with international accounting standards, accounting errors will also be reduced because humans will no longer intervene in the process, thereby rendering financial statements more reliable than they are currently (Uwadiae, 2015). Activities such as bank reconciliation, accounts payable and expense management will also be automated in agreement with Web Accounting. More accounting tasks that can easily be done by computer are: sending audit fee, settlement of invoice payments, risk assessment, calculation analysis, classification of invoices (Erickson, 2017), audit planning, analytical review methods,

materiality assessment, internal control assessment, risk assessment and related decisions and... (Gulin; Hladika; Valenta, 2019). Moudud (2014) in his review emphasizes that digitization and automation are useful for auditors in performing audit planning processes, analytical review methods, materiality assessments, internal control assessment, risk assessment and related decisions. There is research that analyzes how many companies are using digital solutions today and what they expect to be using in the next few years. These researches are mainly initiated and implemented by the largest audit institutions (Moudud-Ul-Huq, 2014), some of which we discussed in the previous sections.

As digitization and automation are used to eliminate or minimize routine and repetitive tasks, it enables accountants to focus on more creative, unusual, and unstructured tasks that require more thought and additional skills. By automated accounting and auditing processes and spending less time, accountants are more connected to their clients and increase their advisory services in daily business operations. This change of approach will affect the future activities of experienced accountants (Gulin; Hladika; Valenta, 2019). Gunthrie and Parker (2016) emphasize that accountants and auditors will experience extensive challenges with the automated processes that complete tasks faster than themselves. According to Forbes (2018), automated provides the opportunity for accountants to become value-added business consultants and analysts. Accountants can then focus on performing more value-added, analytical, and strategic tasks, which in turn may increase their job satisfaction. The automated is expected to enable accountants to improve digital competencies through their knowledge. However, accountants must develop their skills to adapt to the changes that automated brings. Arntz et al. (2017) state that currently some accounting tasks (invoicing, payroll calculation) are automated in many companies (especially in large companies) (Arntz et al, 2017). Therefore, since the beginning, the accounting and auditing profession has been important for development and growth. Automated accounting and auditing processes and changing the requirements of the profession will cause the profession, which today seems to be the only display of compliance with standards and legal requirements, to shut down. Then the opportunity arises for this profession and professionals to excel in other fields of knowledge, such as consulting and business strategy, and to acquire extensive knowledge in education (Sumar, 2021). In their 2013 study, Taipaleenmäki and Ikäheimo proposed a hypothesis suggesting that the advent of automated accounting processes may precipitate a decline in the demand for accounting expertise. They further advanced the argument that it is imperative for employees to cultivate technological proficiency in order to gain an understanding of these automated processes.

It is imperative to recognize the mounting body of research that has identified the potential for automated accounting and auditing when cloud processing, the Internet of Things, big data, artificial intelligence, and blockchain are integrated as the most effective technologies in the accounting and auditing process, or vice versa. The implementation of concepts in different dimensions enables computers to read, recall, analyze, and transfer relevant and timely data for accounting and auditing processes. Upon receipt, the aforementioned data is recorded, purified, classified, transferred, processed, reported, and sent to stakeholders based on standard algorithms and rules and regulations. The results and findings of events and activities are then discussed in a multitude of documentation topics, including deep calculations, financial reporting, risk analysis, proof of management claims, internal control, validation, assurance, and numerous other functions that are performed intelligently and automatically.

Theoretical Foundations

In order to achieve the knowledge and epistemological goals resulting from accounting and auditing in blockchain

technology, this section will describe the related theories, perspectives, models, and approaches. This will provide a comprehensive theoretical framework for this issue, which will be of benefit to those engaged in the field.

Evolution Theory: The genesis of development and evolution can be considered in light of the theory of evolution. Blockchain represents an evolution in technology and a product of digital Darwinism, exhibiting intrinsic perfection. This evolution fosters a more profound and vital interconnection within the tangible realm of industries and companies, culminating in a state of industrial social perfectionism.

Agency Theory: Agency theory seems to be the standard approach to emphasize "the conditions of uncertainty that lead to potential information asymmetries between the executives who manage the firm and external investors" (Walker, 2013). Blockchain can be seen as a non-pecuniary open innovation ecosystem that will help to circumvent opportunistic behaviors that are frequently exercised by a smaller group of individuals in a society, a classic. The same technology can be used in private or semi-private settings where the main aim is to diminish market uncertainties and the asymmetry of information between agents. This results in a reduction of transaction costs and a reformulation of the role of the middleman agent (Torres de Oliveira, 2017). Therefore, blockchain technology facilitates a substantial increase in the efficiency of agency relationships in orders of magnitude and lowers agency costs equally substantially in orders of magnitude. Blockchain technology provides formal guarantees to taking part in principals and agents that address agency problems in corporate governance comprehensively (Kaal, 2019).

Stakeholder Theory: Stakeholder theory recognizes that firms are part of a greater social system and decisions cannot be made in isolation. The theory promotes an open and inclusive relationship with all stakeholders consisting of managers, directors, investors, employees, other companies, service providers, government, and society at large (Freeman, 1994). From the stakeholder theory perspective, blockchain technology can be an effective mechanism to promote an open and inclusive environment. Organizations can promote stakeholder inclusion and expand business opportunities within blockchain networks (Han et al., 2023). The distributed nature of blockchain technology can provide a valuable tool for promoting collaboration and interaction between different people across vast networks. Using AI technology, companies can promote an open and inclusive corporate culture to empower decision-making using blockchain data verified and shared by multiple parties (Vasarhelyi, 2012).

Institutional Theory and Deinstitutionalization Theory: Institutional theory is a prominent perspective in contemporary organizational research (David; Tolbert and Boghossian, 2019) and a powerful lens for examining economic phenomena both at a moment in time and over time (North, 1990). It encompasses a large, diverse body of theoretical and empirical work connected by a common emphasis on cultural understandings and shared expectations. (David; Tolbert and Boghossian, 2019). Institutional theory explains why and how organizational structures and processes become established. This theory deals with the consequences of this institutionalization (Rahnemay Roodposhti and Salehi, 2009). In the meantime, the government, as the largest institution and the main driver, plays a fundamental role in the formation of institutionalization and legalization functions (Kousari & Yari, 2024).

From the perspective of blockchain technology, institutional theory could examine how logistics and supply chain managers attempt to manage space, resources, and legitimacy to overcome institutional pressures. In particular, it could examine how innovative approaches, such as blockchain, by competitors lead to mimetic processes (Kummer et al., 2020). A theoretical analysis suggests that the adoption

of blockchain technology is influenced by two main factors. Given that we are currently observing companies at the forefront of understanding and developing blockchain systems, it is likely that large-scale adoption of the technology will occur from a user perspective. The first factor relates to the legitimacy that underpins the technology, as postulated by Dowling and Pfeffer (1975). In this regard, Naeemi, Yazdifar & Shafiei (2021) believe that it is necessary to first create the necessary grounds for the adoption of this innovation in the organization.

Path Dependency Theory: Path dependency theory (PDT) contains the philosophy that past events influence future events (Bergek & Onufrey, 2013). This theory considers the history of practices (Schreyögg and Sydow, 2011) and builds on this insight to show how past events and practices (can) influence future actions and decision-making (Rowlinson et al., 2014). In the context of blockchain implementation, path dependency theory posits that organizations may adhere to a particular "path" or blockchain standard due to the influence of institutional norms and arrangements. In addition, the phenomenon of "lock-in," which describes the tendency for a standard to become entrenched in the marketplace, can make it difficult to change the standard once it has gained traction, even when alternative options may offer superior efficiency. In the context of blockchain standards, where "a dominant design has not yet stabilized" (Geels, 2004, p. 37), the decision to adopt a particular standard carries inherent risks and uncertainties. There is a possibility that the chosen path may not be consistent with the future dominant design, which could lead to higher transaction costs (Herold et al., 2022). Considering the above factors, it can be suggested that the optimal timing for blockchain implementation may depend on the lock-in effect (Bahli and Rivard, 2003). The goal is to capitalize on a potential cost advantage with respect to transactions. However, path dependency theory posits that the implementation of a particular blockchain standard, whether dominant or alternative, can be self-reinforcing, resulting in a positive feedback loop. This is due to the fact that as the number of individuals adopting the blockchain standard increases, so does the likelihood of further adoption. While this can be beneficial if a dominant design has been chosen, the lock-in effect can also lead to negative externalities and inertia. To illustrate, the adoption of a particular technology may lead to a reduction in the value of competing technologies, thereby limiting their potential for adoption (David, 1985). The cumulative effect of positive feedbacks and negative externalities leads to a particular trajectory where the self-reinforcing nature of the chosen option precludes the possibility of alternative future scenarios, thereby creating a state of inertia driven by the lock-in effect (Herold et al., 2022).

Theory of Professions: The Theory of Professions provides an analytical lens with which to understand the characteristics, attributes, and structure of the accounting profession. The framework includes characteristics that previous research has identified that explain how membership in a profession is achieved by stakeholders (Pollock & Amernic, 1981). In an accounting context, the Theory of Professions is described as the power and reputation granted by society to the profession to protect the public interest, where professionals gain a body of knowledge that is connected to the major needs and values of the social and accounting systems (Pollock & Amernic, 1981). By using this theory to investigate the professional role, it is possible to also examine the accountant's practice. The professional role refers to the expected function an accountant has at a particular company based on the education and knowledge necessary to perform their specific tasks (Greenman, 2017). The purpose of using this theoretical framework is twofold. First, to challenge the conventional definition of the profession. Second, to examine which aspects of the accounting profession are susceptible to automation. In light of these considerations, an analysis can

be conducted to determine which aspects of the accounting firm's employees are or are not replaceable and whether the profession is at risk, as has been discussed in the media. In addition, as noted above, a certain level of education is required for an occupation to be considered a profession. It is important to consider the educational aspects and salary levels of employees when introducing technology into organizations, as these factors can influence the impact of technological advances on the workforce. The phenomenon that technology affects employees with a certain level of education and salary is referred to as job polarization (Törnqvist and Forss, 2018).

Job Polarization Theory: This is a recent, much debated phenomenon, referred to as job polarization, i.e. the simultaneous growth of high-skill, high-wage jobs and low-skill, low-wage jobs at the expense of middle-skill jobs. Prominent explanations for this phenomenon are routine-based technological change and the offshorability and automation of jobs (Heyman, 2016). Job polarization implies that we should expect an increasing employment share for occupations in the higher and lower parts of the wage distribution and that the employment share should decrease in the middle of the wage distribution (Heyman, 2016).

The digitization and automation of occupations has led to a phenomenon known as job polarization. Job polarization is a phenomenon that occurs when the automation of routine tasks increases, leading to increased demand for cognitive occupations and increased employment in low-education occupations due to the displacement of individuals from the middle category of the labor market. As a result, middle-skill occupations are most affected by automation, a phenomenon that is particularly evident in the case of accountants (Goos & Manning, 2007). When the number of tasks, which are completed by the automatic technologies, increases, the process of job polarization appears. It carries out the increased need for cognitive careers and the increase in recruiting for the jobs,

where the low level of education is required. It happens because the middle type of professions is being forced out of the market. The middle type of professions with average pay, where the middle education level is required, is affected the most by the automation of technologies, and this is where the profession of accountants is based (Goos & Manning, 2007).

Information Theory and Information Processing Theory: Information theory is a scientific discipline concerned with the transmission, processing, extraction, and use of information. In this context, information can be defined as the resolution of uncertainty (Tushman and Nadler, 1978). Information theory can be used to link any uncertainty and complexity within the supply chain. The provision of additional information can serve to reduce uncertainty and risk (Jia; Peng; Green; Koh and Chen, 2020). In this regard, information theory provides a foundation for exploring the potential of blockchain to enhance information processing capabilities and increase transparency along the supply chain (Kummer et al., 2020).

Information theory in logistics and supply chain management, as well as in blockchain applications, often addresses the acceptance of information technology and information processing (theory) within information systems. In line with information theory (Galbraith, 1974), information processing theory views organizations as systems that need to process information to reduce uncertainty (Saberi et al., 2019). Therefore, information processing theory can help identify the organization's existing or required information processing capabilities for blockchain data analysis (Bell DeTienne & Jackson, 2001). With the application of blockchain, organizations can adopt information processing theory to evaluate the competitiveness of different blockchain networks (Saberi et al., 2019), to identify information processing requirements from blockchain adoption (Martinez et al., 2019), and to analyze how blockchain transparency can improve existing information processing capabilities (Kummer et al., 2020).

Network Theory and Actor-Network Theory: Network theory is a mathematical framework for modeling interacting systems as networks (or graphs) formed by a set of relations (edges) between discrete entities (nodes) (Ortega et al, 2018). In this context, the field of network theory, more specifically social network theory, examines inter-organizational linkages and relationships and their impact on network management (Mitchell, 1969). In other words, network theory studies the interplay and management of inter-organizational relationships. Similar to transaction cost analysis, network theory examines the links between organizations, but with a focus on relationships rather than transactions (Rinehart et al., 2004).

From the perspective of blockchain technology, the application of network theory can facilitate the examination of the dynamics within inter-organizational networks. An assessment of the function of relationships and information transparency can help managers determine whether personal relationships can be replaced by the enhanced information sharing facilitated by blockchain technology. In addition, network theory can be used to assess the impact of "trustless systems" on business relationships. Such systems can not only automate contract compliance, but also potentially replace personal relationships (Tian, 2016). In their respective studies, Li and Zhou (2020) and Sternberg et al. (2021) propose that blockchain applications in the supply chain context are subject to network effects, where the benefits of the technology are derived from an increasing number of parties adopting the technology. Conversely, McCallig, Robb, and Rohde (2019) present a design for a blockchain-based accounting information system using network analysis.

Transaction Cost Analysis Theory / Transaction Costs Theory: The theory of transaction cost analysis or transaction cost economics is based on the premise that a firm's decision-making process is influenced not only by price but also by the transaction costs associated with the decision (Williamson, 1973). The basic premise of

transaction cost theory is to increase economic efficiency in the exchange of products or services through the marketplace. In addition to production costs, transaction costs are critical in identifying an efficient economic unit and its decision boundary. In addition to the aforementioned categories of transaction costs, Williamson (1975) proposed three determinants of transaction costs - frequency, asset specificity, and uncertainty - as key dimensions that capture the characteristics of economic exchange between institutions. The application of transaction cost analysis can help determine the impact of changes in transaction costs resulting from the advent of blockchain technology. This, in turn, influences the configuration of organizational structures and practices. Consequently, transaction cost economics can shed light on how specific elements of blockchain technology alter the design of contractual arrangements and how automated smart contracts can significantly reduce transaction costs (Kummer et al., 2020). Indeed, blockchain technology can provide value across multiple dimensions by decreasing information asymmetries and reducing related transactional costs (Block et al., 2018).

Innovation Diffusion Theory and Perceived Characteristics of Innovating Theory: Innovation diffusion theory postulates that the decision to adopt or reject an innovation depends on an individual's beliefs about the innovation in question (Karahanna, Straub & Chervany, 1999). The goal of innovation diffusion theory is to elucidate the processes involved in innovation decision making, to identify the determinants of adoption rates, and to categorize different types of adopters. The theory makes it possible to predict the likelihood and rate of adoption of an innovation, thus providing insight into the potential success of a given innovation (Chen, Gillenson & Sherrell, 2002). Diffusion of innovation theory posits that communication plays an important role in social change within a community (Rogers, 1962). Accordingly, the diffusion of

innovation theory model proposed by Rogers is the models used to analyze the communication process of any innovation by the members of a system.

Diffusion of Innovation Theory (DOI) is a foundational theory in the field of consumer behavior that provides insight into the processes by which consumers adopt and use new products and services (Rogers, 1962). The Perceived Characteristics of Innovation Diffusion Theory (PCIT) incorporates three additional attributes, namely image, voluntariness, and behavior that are not present in Innovation Diffusion Theory (IDT). Perceptions of voluntariness influence behavior, which in turn influences actual behavior relative to voluntariness. The results show a strong correlation between adoption rate and demonstrability, suggesting that as demonstrability increases, adoption rate increases. The PCI model posits that observability consists of two sub-characteristics: visibility and demonstrability of results. In addition, the model suggests that the willingness of users to accept or reject an innovation is also influenced by voluntariness (Prashant Dongre, 2022).

Contingency Theory: Liang and Lu (2013) believe contingency theory originates in organizational theory and emphasizes developing the most appropriate management approach to respond appropriately to different situations. Therefore, contingency theory is considered a dominant, theoretical, rational, open system model at the structural level of analysis in organization theory (Scott, 1992). According to this theory: (I), there is no best organizational structure or managerial method that fit all firms, and (II) the effectiveness of any managerial methods or organizational structures depends on internal and external business environments and processes (Galbraith, 1974). The basic assertion of contingency theory is that the environment in which an organization operates determines the best way for it to organize (Scott, 1992).

Contingency theory can help investigate how organizations react to their external environment. So, contingency theory has elements of both science and technology and it makes the organization have a more efficient transformation process (Rabey, 1989: 168). According to this theory, the fit between benefits deriving from technology and the organization's business environment is one of the critical factors managers should consider in adopting technology (Araral, 2020).

Game Theory: Game theory provides a set of mathematical tools for analyzing interactions among decision makers who are assumed to be rational (Liu et al., 2019). In the context of game theory, players can adopt different strategies, influence other players, and receive certain payoffs as a result of their actions (Zhang and Wu, 2021). In a game, each decision maker, as a player, chooses a strategy with the goal of maximizing his utility given the strategies of the other players. The underlying assumption is that each player is rational and will choose a strategy that maximizes his utility because it is the most likely outcome given the available information. This is called a Nash equilibrium. In essence, game theory is a mathematical model that examines the strategic interactions between players with the goal of facilitating sound decision making. Applying game theory to the blockchain platform allows for the study of the strategies employed by consensus nodes. By capturing and anticipating mutually exploitative behaviors, consensus nodes can develop an optimal response strategy focused on maintaining equilibrium. Through game-theoretic analysis, consensus nodes can identify and predict each other's mining behavior, and then develop optimal response strategies based on equilibrium analysis. Incentive mechanisms can be developed through game theory to deter consensus nodes from misbehaving or initiating attacks. Game theory can be used to inform voluntary decision making with the unanimous consent of nodes in the blockchain network. Furthermore, the configuration of the mining apparatus is based on the principles of cryptography and game theory.

Theory of Reasoned Action or Reasoned Action Theory: Fraj and Martinez (2003) put forth the proposition that the theory of reasoned action is predicated on two fundamental assumptions. Primarily, it is based on the assumption that individuals possess the capacity for rationality and engage in a systematic utilization of information. Secondly, it is assumed that individuals consider the potential consequences of their actions before deciding whether to adhere to a specific course of conduct.

This theory recognizes the existence of factors that can interfere with the ability of attitudes to influence behavior (Amalathas et al., 2022). The model postulates that any human behavior can be predicted and explained by three primary cognitive components: attitudes (a person's favorable or unfavorable feelings toward an activity), social norms (social influence), and intentions (a person's decision to perform or refrain from performing a behavior) (Prashant Dongre, 2022). According to the theory of reasoned action, an individual's attitude toward a particular behavior is a function of his or her behavioral intention, which in turn is a function of his or her attitude toward the behavior in question and his or her subjective norms (Fishbein, 1979). In the context of blockchain technology, an organization's attitude is shaped by its assessment of blockchain's potential to provide solutions. Subjective norms include the influence of productivity achieved by other industries and competitors, although these are weighted by the assessment of decision makers within the organization. Behavioral intentions can be understood as the actions of top management, such as discussing blockchain in strategic meetings and forming teams for research and development. This theory provides a basis for the various theories mentioned (Dua, 2023). This theory also considers the implementation of accounting and auditing on the blockchain platform. It examines the components of intention, attitude, and norms resulting from effectiveness, efficiency,

economy, and their interactions with the accounting profession and society.

Theory of Planned Behavior and Decomposed Theory of Planned Behavior: This theory is an extension of the Theory of Reasoned Action (TRA) (Dua, 2023). While both the Theory of Planned Behavior (TPB) and the TRA assume that an individual's behavioral intention (BI) influences his or her behavior, the TPB employs perceived behavioral control (PBC) for actions that are not under the individual's volitional control (Prashant Dongre, 2022). In light of this, the Theory of Planned Behavior incorporates perceived behavioral control (PBC) as a novel variable within the Theory of Reasoned Action. PBC is primarily influenced by the accessibility of resources, opportunities, and competencies, as well as the perceived importance of these resources, opportunities, and competencies in achieving outcomes (Prashant Dongre, 2022). The Decomposed Theory of Planned Behavior (DTPB), proposed by Taylor & Todd (1995), consists of a decomposition of the Theory of Planned Behavior (Ajzen, 1991). The objective of this theory is to facilitate a more nuanced understanding of the relationships between belief structures and antecedents of intention (Taylor & Todd, 1995).

In the context of blockchain technology, the term (PBC) is used to describe a firm's capacity to achieve its desired objective through actions or decisions made in relation to blockchain technology. This capacity is contingent upon the firm's ability to align with technological advancements (Dua, 2023). Furthermore, the potential of the PBC to streamline automated accounting and auditing processes, the feasibility of its integration, the capacity to exert control over blockchain technology in this domain, and the relative ease or difficulty of doing so will be evaluated.

Theory of Interpersonal Behavior: The Theory of Planned Behavior (TPB) has been the subject of considerable criticism for its perceived inadequacy in explaining the emotional dimension of consumer behavior. The TPB explains behavior through intention

and is considered a static model based on self-interest motives that excludes emotional and unconscious influences (Lopes et al., 2019). But the important thing is that habits also moderate behavior and both of these effects are moderated by facilitating conditions (Berenji, Rahmaty & Kiakojouri, 2024). In contrast, the Theory of Interpersonal Behavior (TIB) provides a rationale for emotional responses along with an explanation of cognitive and social influences to predict consumer behavior (Donovan, 2011). This theory primarily elucidates the intricacies of human behavior, elucidating how social and emotional factors exert influence. Consequently, to enhance predictive efficacy, this theory incorporates not only the full range of elements encompassed by TRA and TPB, but also habits, facilitating circumstances, and affect. Roles, norms, and self-concept are integral to the social factors construct, which is closely aligned with the subjective norms notion in TRA. In essence, an individual within the TPB framework is neither exclusively deliberate nor entirely automatic, nor wholly autonomous nor entirely social.

Integrated Behavioral Model: The Integrated Behavioral Model (IBM) represents a logical progression of the three social science theories of Reasoned Action, Planned Behavior, and Interpersonal Behavior.

According to the Integrated Behavioral Model (IBM), determinants of individuals' behavioral intentions are their experiential and instrumental attitudes toward the behavior, their descriptive and injunctive norms, and their perceptions of the difficulty or ease of performing the desired behavior and perceived self-efficacy (Glanz & Viswanath, 2008). These factors are grouped into four categories: Experiential Attitude, Descriptive Norm, Personal Agency, and Self-efficacy (Glanz et al., 2008). The next construct in the Integrated Behavioral Model is the perceived norm, which encompasses the social pressure an individual may experience regarding the performance or

nonperformance of a particular behavior (Fishbein, 2007).

Affect, Behavior and Cognition Model: The ABC model includes the three elements; affection, behaviour and cognition (Breckler, 1984) that ABC is made up of three components, affective, belief, and cognitive (Van Harreveld et al., 2015). In this context, an understanding of blockchain technology can engender a different attitude towards it. Furthermore, an awareness of the influence of automated accounting and auditing on the blockchain technology platform will inform perceptions of the technology. Using the structural components of the ABC model, this question can be answered as follows: The technological competence of the accountant and auditor can be considered as an effect component. The ease or difficulty with which technology is understood and utilized can influence perceptions of automated accounting. The perception of the technology may be either straightforward or challenging, contingent on the level of familiarity with it. The behavioral component can be attributed to the accountant's or auditors previous experience with accounting and auditing in the context of digitization, automation, and automation of certain procedures. Furthermore, the individual's attitude toward the automation of accounting and auditing in the blockchain technology ecosystem exerts an influence. The cognitive component can be exemplified by accounting and auditing beliefs and knowledge about automated accounting and auditing processes and blockchain technology. These beliefs and knowledge are shaped by previous experiences and by information from various sources, including industry rumors, social environment, society, and media. These factors can influence the accountant's attitude and auditor's influence.

Motivational Model and Igbaria's Model: The Motivation Model (MM) posits that extrinsic and intrinsic motivation are the primary determinants of an individual's intention to engage in a behavior. Furthermore, intention to perform a behavior

is a construct that is closely related to actual behavior (Venkatesh & Speier, 1999).

The motivation model postulates that user behavior is shaped by both extrinsic and intrinsic motives. Extrinsic motivation, as defined by Davis, Bagozzi, and Warshaw (1992), can be understood as the belief that people act to achieve external goals that are not directly related to the activity itself. These external goals may include improved job performance, compensation, or promotion. Examples of extrinsic motivation include perceived utility, perceived ease of use, and subjective norm. In contrast, intrinsic motivation is defined as behavior that results in a sense of pleasure and satisfaction for the individual (Vallerand et al., 1997). In the context of blockchain technology, external factors such as peer pressure, regulatory requirements, industry needs, and customer demands will drive its adoption. Conversely, the intrinsic motivation for any organization would be innovation, competitive advantage, and value creation (Dua, 2023). Given these benefits, the implementation of blockchain technology in the automation of accounting and auditing processes is a compelling proposition. The benefits of this approach, which include transparency, reliability, integrity, relevance, and utility, provide a solid rationale for its implementation.

Social Cognitive Theory: Social Cognitive Theory (SCT) was developed using three key factors: behavior, personality, and environment. These factors interact bidirectionally to predict group and individual behavior. SCT is an inseparable triadic structure in which all three components always influence and determine each other. The SCT model is used to assess the use of information technology by incorporating several factors such as self-efficacy, performance expectations, anxiety, affect, and personal outcome expectations (Prashant Dongre, 2022). This theory, which deals with the concepts of human agency and human capability, posits that humans are self-developing entities who acquire knowledge through a combination of symbolic and direct factors. The personal factors that influence

this process include, but are not limited to: self-evaluation goals, self-efficacy, social comparison, and values. The environmental factors that influence this process include, but are not limited to, the social model, feedback, norms, and rewards. Finally, the behavioral factors that contribute to this process include, but are not limited to, the choice of action, the effort to learn, the continuity of use, and the achievement of goals through the use of these factors (Dua, 2023). In the literature on socio-technical issues, the interrelationship between people and technology is a recurring theme (Sawyer & Jarrahi, 2014), as is the relationship between socio-technical system components (Borrás & Edler, 2020).

In the context of blockchain technology, personal factors can be broadly classified into three categories: technical, environmental, and behavioral. Technical factors relate to the technical assessment of the company in terms of efficiency and comparison with industry standards. Environmental factors include feedback from value chain partners or customers regarding the adoption of blockchain technology. Finally, behavioral factors include the decision to adopt blockchain technology, the consistency of efforts, and the achievement of desired objectives through its use (Dua, 2023). In the context of accounting and auditing, the emotional responses associated with anticipated enhancements in personal and professional status and performance are of interest. These include the experience of pleasure and satisfaction, as opposed to anxiety and dissatisfaction, as well as the sentiments of success or failure in task completion.

Technology Acceptance Model: The Technology Acceptance Model (TAM) represents an adaptation of the Theory of Planned Behavior (TPB), as originally proposed by Fishbein and Ajzen (1975). The TAM model is attractive because of the theoretical and psychometric ambiguity of the TRA model, applied subject norms are removed (Prashant dongre, 2022). The TAM intends to explain the behavior of the users of a computer system, claiming that the use of

the computer system depends directly on the intention that the individual has in using it (Almeida, 2002). The TAM model theories that individuals' attitudes towards new technology are determined by two primary factors (Davis, 1989). The model's strength comes in its simplicity (Prashant dongre, 2022).

In 2000, the model was extended by Davis and Venkatesh that added several impacts to the factor perceived usefulness. The aim was to increase the understanding of user acceptance and usage of new systems. The first three impacts that were added were; subjective norm, voluntariness and image. These are reflected as social forces affecting individuals' attitude to either adopt or reject a new technological system (Davis & Venkatesh, 2000). Three additional factors were incorporated into the model: job relevance, output quality, and result demonstrability. These cognitive determinants are subcategories of perceived usefulness and were included because they are perceived as impacting whether individuals accept technology (Davis & Venkatesh, 2000). In light of these considerations, Venkatesh and Davis developed and refined the Technology Acceptance Model (TAM) to include additional critical determinants of perceived usefulness and intention to use. These included social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, outcome demonstrability, and perceived ease of use). This led to the development of TAM2.

In order to improve the adaptability, explanatory power, and specificity of the Technology Acceptance Model (TAM), the Extended Technology Acceptance Model (ETAM) incorporates a number of novel elements. The concept of ETAM has been proposed in two different research studies. TAM2 was the first study to examine the emergence of perceived usefulness and behavioral intention (BI). TAM2 shows superior performance in both voluntary and mandatory contexts. The only exception is subjective norms, which are influential in mandatory contexts but not in voluntary contexts. The second study provided insight into the factors that influence perceived usability. The two primary categories of antecedents that influence perceived usability are adaptations and anchors. The anchors group includes general beliefs about using computer systems, including enjoyment and objective usability. In contrast, the adaptations group includes beliefs formed based on direct experience with a system, such as external control, computer self-efficacy, computer anxiety, and computer playfulness (Prashant Dongre, 2022).

The most current version is TAM 3, which presents a complete nomological network (integrated model) of the determinants of IT adoption and use by individuals (Venkatesh & Bala, 2008). Venkatesh et al. (2003) integrate multiple models, such as task technology matching model, rational behavior theory, and planned behavior theory, and propose the integration theory of technology acceptance and utilization (UTAUT). This led to TAM3, which contains all variables of the above model (Venkatesh & Bala, 2003). The TAM and its extended version are two of the most widely used frameworks for understanding user acceptance of information technology.

The perceived usefulness of blockchain technology is largely dependent on its interoperability and the potential it offers companies to gain a strategic advantage. Although blockchain has demonstrated its usefulness in financial transactions, it has yet to prove its effectiveness in addressing operational issues. The perceived ease of use is dependent on the company's comfort with the technology and its ability to sustain the change or adoption of blockchain technology (Dua, 2023). In the context of blockchain technology, voluntariness can be defined as the strategic willingness to adopt its distinctive features. Such factors may include the firm's affinity for trust, transparency, robustness of the system, and interoperability. In addition, the analysis will take into account the firm's previous

experience with the adoption of previous information technologies. As mentioned earlier, the influence of subjective norms remains unchanged. The image, however, represents the perception of clients and customers of the remaining technology updates. The relevance of the job in question will be consistent with the industry in question. The trust that blockchain can provide in terms of operational and financial output depends on the demonstrability of the quality of the output. The additional constructs indicate the social influence process and cognitive instrumental processes. Social influence processes include subjective norms, voluntariness, and image, while cognitive instrumental processes include job relevance, output quality, and outcome demonstrability. The construct can be reflective or formative depending on the situation (Dua, 2023).

The advancement of technology acceptance models has been driven by the necessity to guarantee user satisfaction and to anticipate system success. It is conceptually appropriate to examine blockchain technology acceptance. This is because, according to the goals of the principles of accounting and financial reporting, information must have certain features to be applicable to users. Consequently, the positive effect of blockchain technology on the quality characteristics of information will confirm the usefulness of this technology in accounting and financial reporting. Furthermore, the use of technology acceptance models can explain the attitude towards accounting and automatic auditing from the perspective of technology.

Unified Theory of Acceptance and Use of Technology: The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by synthesizing eight models of information technology acceptance research, including the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), and the Motivational Model (MM). It also includes the Theory of Planned Behavior (TPB), which integrates the Technology Acceptance Model and the Theory of Planned Behavior, the Model of PC Utilization (MPCU), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). As a result, this theory is very comprehensive and is referenced in the seminal work of Venkatesh et al. (2003).

As proposed by Venkatesh et al. (2003), Performance Expectancy, Effort Expectancy, and Social Influence are believed to exert influence on Behavioral Intention in the context of technology usage. Conversely, the UTAUT model posits that Behavioral Intention and Facilitating Conditions determine Use Behavior. Additionally, individual difference variables, including age, gender, experience, and voluntariness of use, were formulated to serve as moderating factors in the aforementioned relationships.

The model describes four constructs of technology use: performance expectancy, effort expectancy, social influence, and facilitating conditions (Dua, 2023). Bouten extended the explanatory power of the UTAUT model by integrating the compatibility beliefs proposed by Karahanna and Agarwal into the original UTAUT model developed by Venkatesh and Morris. In addition, the model aims to elucidate the processes by which the cognitive phenomena of the UTAUT model are generated by developing and testing novel boundary conditions (Prashant Dongre, 2022). The objective of UTAUT2 is to expand the scope of UTAUT by incorporating considerations of the consumer use context, thereby providing a more comprehensive framework for understanding the factors influencing technology adoption. This permits a more detailed and sophisticated comprehension of the elements that shape the adoption of technology. This is particularly important given the observed discrepancies between consumer and organizational contexts. The UTAUT2 model introduces three additional constructs to the original UTAUT model: Hedonic Motivation (HM), which can be defined as the enjoyment derived from using the technology; Price Value (PV), which represents the consumer's cognitive trade-off

between the perceived benefits of the application and the monetary cost of using it; and Social Influence (SI), which represents the degree to which individuals are influenced by the opinions of others in their social networks. This construct was excluded from the questionnaire because participants lacked the necessary knowledge about the cost of the technology. The habit (HB) construct represents the learning curve and the extent to which learning automates the tasks to be performed with the technology. It is also equated with automaticity by Venkatesh et al. (2020).

The disparate compatibility beliefs proposed by Karahanna et al. (Karahanna, Agarwal, and Angst, 2006) and the UTAUT model developed by Venkatesh et al. were synthesized by Bouten in 2008 to create the C-UTAUT model. The term "compatibility beliefs" is defined as the degree to which a new system is aligned with an individual's preferred work style, existing work practices, prior experience, and values. This model aims to provide a comprehensive analysis of the cognitive aspects of the UTAUT model, with a particular focus on the influence of recognizing and evaluating new limitations (Bouten, 2008).

In the context of blockchain technology, performance expectancy can be defined as the confidence that the adoption of blockchain will achieve the desired objective for which stakeholders have adopted it. Effort expectancy, on the other hand, is the confidence that the organization will effectively manage and use the blockchain. Social influence in blockchain can be thought of as analogous to peer pressure, which an organization experiences and confirms is necessary. Enabling conditions for blockchain can be defined as the availability of service providers that support and/or guide the blockchain transformation (Dua, 2023). Blockchain technologies currently require some technical background so it is expected that habit affects intention to use and adopt positively. The defined constructs are expected to be moderated by the variables: age, gender, and experience; with experience being the occasion to use a technology that varies since the system was used for the first time (Venkatesh et al, 2003). Moreover, with regard to the issue of compatibility, it is possible to make reference to the compatibility of this technology with existing expectations, current work procedures, professional experiences, and values.

Technology Readiness Acceptance Model: Lin (2007) sought to construct a model that integrated the Technology Acceptance Model (TAM) and the Theory of Reasoned Action (TRA) to elucidate user acceptance of technology-based electronic services. This integrated model is based on the two dimensions of perceived usefulness and perceived ease of use and is based on the Technology Readiness Acceptance Model (TRAM).

TRAM combines the general dimensions of TRI with the specific dimensions of TAM system to explain how individual readiness can affect individual interaction, experience, and use of new technology (Khadka & Kohsuwan, 2018). TRAM can explain how the personality dimension can affect a person in their interactions using new technology (Lin & Sher, 2007). Therefore, TRAM is widely used in research to determine the readiness and acceptance of an information system (Aripradono, 2021). In TRAM, there are seven variables: optimism, innovativeness, uncertainty, discomfort, perceived usefulness, perceived ease of use, and intention to use (Aripradono, 2021). TRAM is used to determine the impact of readiness on IT adoption in organizations because the factors that motivate an individual's inclination to use a system (intention to use) are shaped by perceived usefulness and perceived ease of use (Davis, 1989).

Task-Technology Fit: The Task-Technology Fit (TTF) model was developed by Goodhue and Thompson (1995) to explain technology use by examining the fit of the technology to the user's tasks/requirements. Unlike other prior research, which had mainly focused on the antecedents of use and intention, the TTF was the first theory to aim

to explore the post-adoption aspect of technology utilization.

The Task-Technology Fit (TTF) acceptance model proposes that users will accept a new technology if it is sufficiently efficient in performing the tasks they perform on a daily basis. In this sense, the acceptance of the new information system depends largely on the user's daily routine tasks (Goodhue & Thompson, 1995). The degree to which the task at hand and the technological support provided to accomplish it are aligned is a critical determinant of the overall success of the system. In the TTF model, task-technology fit is defined as the extent to which the functionality of a technology matches the requirements of a task and the capabilities of the individual performing the task. The model uses four concepts: task characteristics, technological characteristics, task-technology fit, and use and acceptance. The task characteristics and technological characteristics serve to determine the task-technology fit, which in turn leads to the acceptance and use of the information system (Goodhue & Thompson, 1995). The TTF analysis shows that blockchain characteristics of transparency, immutability and programmability are very useful for addressing the tasks that need to be performed while meeting user needs. However, additional characteristics, such as automation, user-experience design, and communication support also need to be provided (Chaudhuri et al., 2022).

Model of Acceptance with Peer Support: This model is one of the most comprehensive in the field and uses seven constructs: behavioral intention, system use, facilitating conditions, network density, network centrality, value network centrality, and value network density. The theory posits that an individual's social network with employees of an organization influences technology acceptance (Dua, 2023). The Model of Acceptance with Peer Support (MAPS) synthesizes previous research on individuals with relevant social network elements in a way that facilitates the extension of previous concepts. The authors propose that social

relationships fall into two categories. The first category includes relationships in which employees seek help from their peers, which can facilitate the acquisition of knowledge about how to use the system. The second category refers to relationships in which employees provide assistance to their colleagues, thereby enhancing their understanding of system configuration and deployment (Prashant Dongre, 2022). In their 2009 study, Sykes and colleagues identified two distinct categories of social connections between employees and others in the context of technology use. One of these connections is seeking help from other employees, while the other is providing help to other employees. The first of these is referred to as the "get help" type, while the second is referred to as the "give help" type. These are extended as value network centrality and value network density. The concept of value network centrality is based on the premise that a focal employee has control over system-related resources. In contrast, value network density refers to the degree of connectivity between the focal employee and other individuals. The degree of control has been shown to influence a number of key network-related variables, including value network density, the dissemination of information, the acquisition of knowledge, and other tangible resources that facilitate the functioning of the network. Behavioral intention is defined as the likelihood that an individual will engage in a particular behavior in a given context. System Usage is used to describe the extent to which a particular technology or product is used. It represents the expected frequency and duration of technology use. Enabling conditions are defined as beliefs about the supporting infrastructure associated with the use of the technology. Network density is described as the connectedness of the network and is defined as the number of connections in the network relative to the maximum number of connections.

In the context of blockchain technology, behavioral intention can be defined as the likelihood that an organization will adopt

blockchain applications. System usage, on the other hand, refers to the adoption and enabling conditions of blockchain technology by end users. The enabling conditions depend on the availability of the technology at affordable prices and the capabilities of the provider offering the blockchain transformation. The term "network density" is defined as the percentage of peers using blockchain technology. The value of a network's centrality for blockchain is determined by the perception of customers and peers that blockchain is a critical component for maintaining business operations. The value of a network's density for blockchain is indicated by its adoption by other value creators, such as suppliers, distributors, and other value creators (Dua, 2023).

Initial Trust Model: The initial trust model (ITM) was defined by Kim and Prabhakar (2004) as "the intention of customers to use trust to satisfy needs in the absence of experience or reliable, detailed information". Building on this concept, Kim et al. (2009) developed the ITM, which posits that initial trust in m-banking can be explained by three factors: structural assurance, personal propensity to trust, and firm reputation.

As a fundamental element of ITM, structural assurance (SA) can be defined as the perceived legal and technical protection of specific users (Mahfuz et al., 2016) and its influence on initial trust. In the context of digital currency transactions, the initial trust experienced by individuals is shaped by the dual role of relevant government agencies, industry regulations, social oversight, and contractual agreements. In the context of monetary transactions, the need for structural assurance is particularly evident. The emergence of a novel money market has made digital currency payments vulnerable to a variety of risks. In particular, due to the lack of direct experience, users tend to view structural assurance as a critical factor prior to the adoption of digital currency payments that influences initial trust (Kim and Prabhakar, 2004). Structural assurance

directly affects initial trust and emerges as a dominant antecedent of initial trust, thereby increasing the intention to use the technology. Initial trust is enhanced when users perceive or receive structural assurance.

The term "personal propensity to trust" is used to describe the degree to which an individual is predisposed to place trust in other individuals with whom they have established a close relationship in a variety of circumstances (McKnight et al., 2002). The term "personal trust propensity" is used to describe the degree to which an individual is inclined to rely on other individuals with whom they have established a close relationship in a variety of situations (McKnight et al., 2002). A higher propensity to trust technology has been shown to result in a significant increase in users' trust intensity (McKnight et al., 2002). Personal trust propensity is an attribute, characteristic, and experience that is shaped by a person's cultural background and psychological education (Lee and Turban, 2001). In the absence of prior knowledge, users with a higher propensity to trust may assume that services are reliable.

The term "corporate reputation" is defined as the firm's ability to provide efficient service to users and the reliability of users' participation in the firm's transactions (McKnight et al., 1998). The term "corporate reputation" encompasses the firm's ability to provide services, the reliability of its business activities, and the reputation of the firm itself (McKnight et al., 1998). As a result, a significant number of high-profile firms proactively provide after-sales support to consumers, disseminate information promptly, and emphasize their technological expertise. They also encourage customers to trust the company's extensive technical capabilities and unparalleled competitive advantage. This enhances the initial trust in the business operation platform (Wu and Lee, 2017).

Convenience, flexibility, and perceived benefits, such as the role of service efficiency, are associated with the formation of initial trust (Koufaris & Hampton-Sosa,

2004). In cases where users have minimal or no experience and are considering accepting novel services, initial trust is of paramount importance (Kim, Shin, & Lee, 2009). The role of initial trust in e-commerce is associated with areas such as online shopping (Lowry, Vance, Moody, Beckman, & Read, 2008) and mobile banking services (Mallat, Rossi, & Tuunainen, 2004), where extensive research has been conducted. Considering the above factors, the elements that contribute to the formation of trust in the acceptance and use of blockchain and process automation technology can be observed in relation to performance expectations, facilitating conditions, legal and technical assurances, risk-taking propensity and an individual's propensity to trust, advertising, and the reputation of the technology in question.

Ethics code of conduct for professional

The fundamental factors that ensure the growth and expansion of professions such as accounting and auditing are professional ethics and a code of conduct. Ethics can be defined as a set of principles that serve as a guiding framework for professional conduct, with the objective of meeting the expectations of the wider society or relevant stakeholders. The fundamental principles of professional ethics in accounting are as follows: 1) Integrity, 2) Impartiality, 3) Competence and professional care, 4) Confidentiality, 5) Professional conduct, 6) Professional principles and rules.

The blockchain platform is characterized by a number of key features, including decentralization, distributed databases, distributed ledgers, peer-to-peer communication, and synchronous networks. These features align with automated accounting and auditing practices, which facilitate transparency, justice, fairness, and equality by eliminating or reducing ambiguity, uncertainty, conservatism, secrecy, information asymmetry, a lack of conflict of interest, and providing access to stakeholders. These cases are founded upon ethical and human principles that serve as the bedrock of all disciplines of knowledge,

including accounting and auditing. Furthermore, the platform eliminates the need for intermediaries, authenticates individuals, directly detects transactions, and immediately registers events. Furthermore, the platform utilizes logical reasoning, robust calculation algorithms, objectivity, network integrity, the irreversibility of transactions, the immutability of documents, verifiability, traceability, and the completeness of information. Blockchain technology enables the fulfillment of ethical principles, including integrity, honesty, impartiality, independence, competence, professional care, professional behavior, and the reduction of moral risk. This, in turn, engenders trust and reassurance. Furthermore, the platform incorporates a number of additional features, including cloud storage, cybersecurity, information security, differentiated access, system integrity, non-repudiation, ownership verification, smart contracts, cryptography, tamper resistance, distributed information, consensus mechanisms, and control consolidation. Furthermore, blockchain technology facilitates compliance with the principles of care and confidentiality, thereby providing security for the beneficiaries.

The most advanced technologies, including artificial intelligence, the Internet of Things, big data, and cloud computing, are employed in conjunction with the distinctive characteristics of blockchain. This combination of technologies, algorithms, and rigorous logical calculations ensures the highest possible accuracy and quality in the collection, processing, recording, and reporting of information. Moreover, blockchain's potential for transformation allows it to operate at a high level of efficiency. Moreover, it is crucial to possess a certain degree of knowledge and awareness. Consequently, accountants and auditors are obliged to obtain the requisite knowledge and enhance their professional abilities in accordance with the digital transformation. In order to fulfill the primary objective of accounting and auditing, which is to assist stakeholders in decision-making, it is imperative that these professions remain

informed of the latest developments in the business world. This necessitates not only the acquisition of the requisite knowledge but also the guarantee that the operational capacity of accountants and auditors is not constrained by outdated practices. The objective is to enhance their analytical capabilities and fulfill their responsibilities in a more effective manner. This issue pertains to the ethical principles of competence, care, and professional conduct in accounting.

Methodology

The majority of existing studies have concentrated on the technical aspects of blockchain, and thus far, no comprehensive scientific framework has been established for this technology. In this context, this research endeavors to provide a theoretical, conceptual, and ethical framework that elucidates the most significant impact of blockchain technology on accounting and auditing.

This research uses a teleological methodology. This research has two primary objectives: first, to expand the existing body of knowledge, and second, to fill the identified knowledge gap. To achieve this goal, a systems approach was used in the modern approach to Future Technology Analysis (FTA). This approach was used to examine the fundamental principles underlying blockchain technology and its applications in accounting and auditing. This topic is aligned with the premise of automated accounting and auditing in the context of blockchain technology, which is of significant interest for two main reasons. First, the topic under study is innovative. Second, it has an international scope and the potential for scientific and practical applications. The conceptual, theoretical, and ethical framework of the topic was designed and explained based on a content analysis of 137 scientific, reference, and library sources available in the Elsevier and Web of Science databases. This analysis was conducted using Atlas.ti v9 and ConceptDraw software.

In order to achieve the knowledge and epistemic objectives that arise from the processes of automatic accounting and auditing within the context of blockchain technology, it was first necessary to conduct an examination of the fundamental concepts that underpin the research topic. Based on this examination, a conceptual model of the research was then developed. The conceptual model was based on four core topics: accounting, auditing, blockchain technology, and automation systems. Subsequently, a comprehensive examination was conducted of all pertinent theories, perspectives, frameworks, and methodologies. This analysis enabled the clarification of the theoretical framework that underlies the research. The theoretical model was constructed on the foundation of 38 pertinent, efficacious, and pervasive interdisciplinary theories and models in the domains of finance, accounting, and auditing. Of the 26 theories identified, 24 were deemed to be distinct and unique, upon which the theoretical framework was constructed. Finally, the key features of the research subject were examined in the form of six vital ethical concepts affecting social, economic, cultural, and political issues, as well as the ethical model.

Results

Conceptual Framework of Automated Accounting and Auditing in the Platform of Blockchain Technology

The analysis of literature and research dimensions in the general conceptual model permits the construction of a mental map derived from cellology, or the so-called neural network in this research. This map is presented in the figure below.
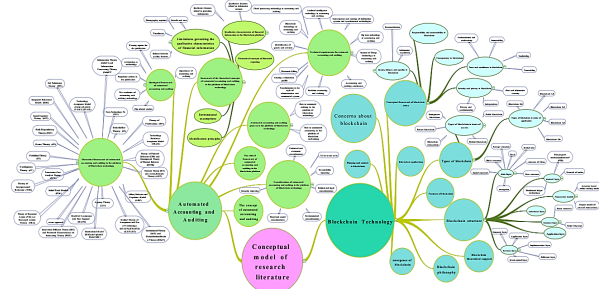
Figure 1. *Conceptual model and mind map of research literature. Source: Authors. (Concept Draw)*

The results of accounting, automatic auditing, and blockchain technology as the primary networks and vital components of this phenomenon encompass a multitude of scientific, practical, and philosophical aspects of scientific and practical events.

Theoretical Framework of Automated Accounting and Auditing on the Blockchain Technology Platform

A review of the existing literature on the subject revealed the existence of 38 interdisciplinary theories and models related to effectiveness and impact in finance, accounting and auditing. Of the total number, 26 were identified as pure and distinct from the others. The figure below illustrates the theoretical framework that emerged from the research.
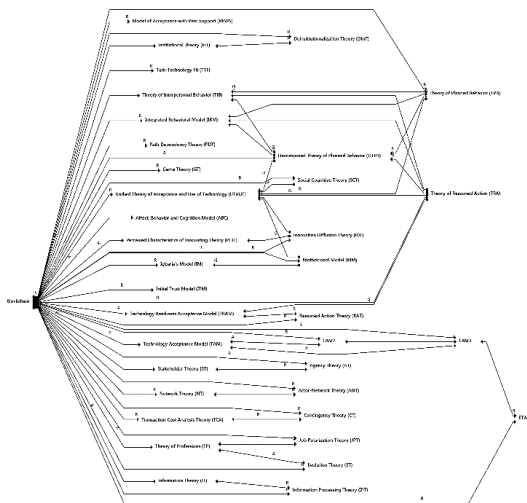
Figure 2. *Theoretical connections of Automated Accounting and Auditing on the Blockchain Technology Step 1. Source: Authors. (Atlas. ti v9)*
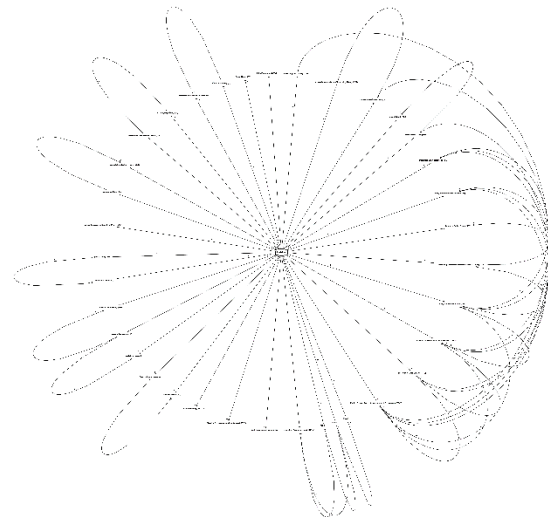
Figure 3. *Theoretical connections of Automated Accounting and Auditing on the Blockchain Technology Step 2. Source: Authors. (Atlas. ti v9)*

The figure below illustrates the initial theoretical framework that emerged from this analysis, based on the aforementioned approach.
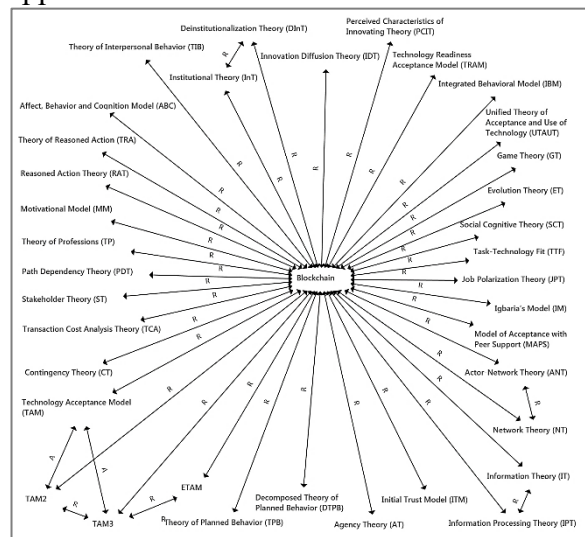
Figure 4. *The explanatory theoretical framework of accounting and auditing in the context of blockchain technology. Source: Authors. (Atlas.ti v9)*

This model incorporates a multitude of elements, including processes, instruments, sentiments, convictions, attitudes, motivations, circumstances, value, importance, necessity, dependence, proclivities, individual factors, social factors, economic factors, political factors, contextual factors, and professional principles within the

domains of financial, accounting, and auditing. These factors extend across the past, present, and future. Subsequently, in order to facilitate a more comprehensive and useful understanding of the theoretical framework, it was ordered and structured. The resulting model of the theoretical framework from the research is illustrated in the figure 5.
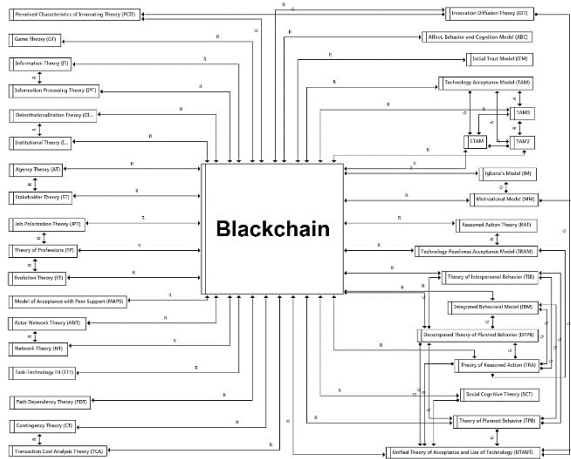
Figure 5. *Theoretical framework of blockchain technology. Source: Authors. (Atlas. ti v9)*

The framework developed in this study is based on an analysis of society's norms, expectations, and demands, as well as an assessment of the characteristics and performance of blockchain technology. It encompasses numerous technical, cultural, social, economic, political, and contextual factors from a mixed perspective and with a systemic approach.

Ethical Framework of Automated Accounting and Auditing in the Platform of Blockchain Technology

A comprehensive search and review of 137 study sources available in the Elsevier and Web of Science databases yielded 46 related study titles. The monitoring and coding of the extracted sources in the Atlas.ti software revealed the presence of 19 distinct and noteworthy features. The study sources were found to include the following elements: encryption, smart contracts, elimination of intermediaries (direct transmission), integrity (system stability), hashing (reproducibility), authentication, record keeping (secure storage), immutability (irreversibility),

access, non-repudiation, consistency, verifiability, traceability (control), digital signature, information asymmetry, peer-to-peer network, decentralization (shared), consensus mechanisms, and distributed ledger. Each of these topics is based on the content analysis of the citation sources and their convergence based on the vital and effective ethical concepts of responsibility and accountability, transparency and disclosure, justice and equality, trust and confidence, security and privacy, guidance, planning and control, flexibility, and relevance. The data was organized and structured. Figure 6 illustrates the network-oriented communication structure resulting from the coding of the ethical components of blockchain technology in the Atlas.ti software.
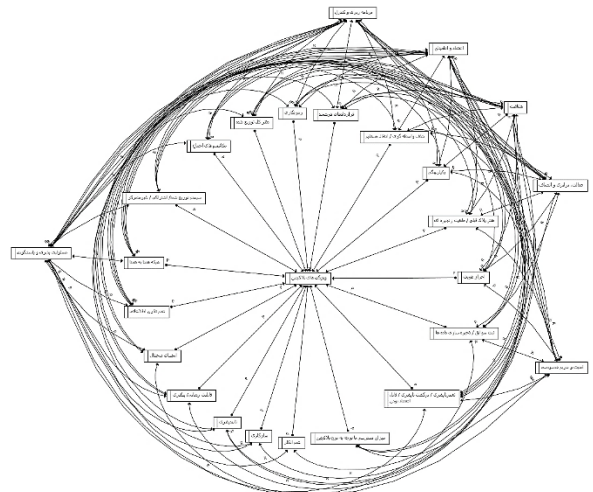
Figure 6. *Communication network of ethical components of blockchain technology. Source: Authors. (Atlas. ti v9)*

In order to facilitate comprehension of this communication network, its structure was summarized and classified in the following
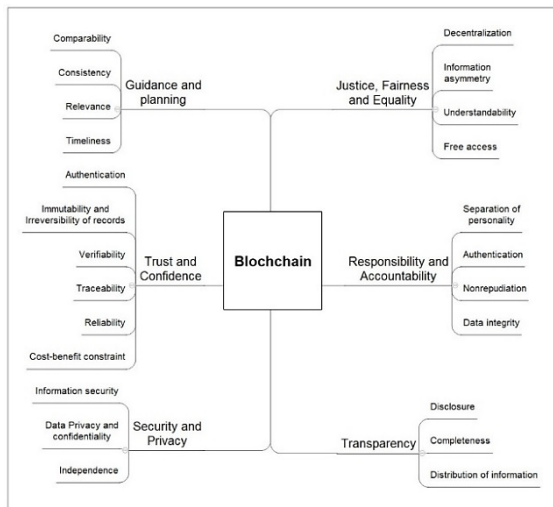
sections. The figure below depicts the final conceptual model of the blockchain ethical framework that emerged from this research.
Figure 7. *Ethical framework of blockchain in finance, accounting and auditing. Source: Authors. (Atlas. ti v9)*

A comprehensive overview of the model's contents has been meticulously prepared and is presented below for your consideration. 1) Responsibility and accountability: The separation of personality; authentication and authenticity; non-denial; integrity, 2) Transparency and disclosure: Disclosure; completeness; information distribution and distributed ledger, 3) Justice and equality: Information asymmetry; lack of concentration; distributed, comprehensible; public and private access, 4) Trust and confidence; immutability; irreversibility; verifiability; traceability; reliability; increasing benefits over costs, 5) Security and privacy: information security; independent; elimination of intermediaries; confidentiality of data, 6) Direction, planning and control: comparability; consistency; uniformity; relate; timeliness was explained and classified.

Discussion and Conclusions

The future of research and systems thinking in new technologies is of great importance for the strategic planning and strengthening of future areas of focus. The capabilities, power, and high growth rate of technologies have enabled profound technical, economic, and social developments over recent years. These developments have given rise to a phenomenon that may be termed "digital neo-Darwinism." Meanwhile, blockchain technology represents one of the most significant innovations to emerge from social demand. Blockchain technology represents a natural response to several global factors and needs that have given rise to a new social concept, influencing the way people live, interact, and communicate, as well as business processes. The pinnacle of this phenomenon's manifestation and penetration in the domains of accounting and auditing can be regarded as a platform that automates accounting and auditing processes. This critical issue has resulted in substantial transformation and advancement in the domains of information systems, credit, and reporting. The significance, necessity, and international scope of this phenomenon have prompted an investigation into the recognition and explanation of its concepts and scientific framework, with the aim of ascertaining its true nature and scope.

The results of the content analysis conducted in this study present a structured model based on the characteristics and potential applications of blockchain technology. This model incorporates fundamental principles and a diverse range of scientific disciplines.

The results of the literature analysis and the research findings, as presented in the conceptual model, indicate that automated accounting and auditing, in conjunction with blockchain technology, represent the primary network and vital veins of the phenomenon of domestication. These elements encompass a multitude of scientific, practical, and philosophical dimensions pertaining to events and activities. Blockchain technology represents a novel distributed infrastructure based on the principles of registration, distribution, encryption, consensus, and modern intelligence in a chain of data and

information. It is an organized base with a structure of multiple layers, including a data layer, network layer, consensus layer, contract layer, service layer, and application layer. In addition, the potential to leverage and derive value from other emerging technologies (such as cloud computing, internet of things, artificial intelligence, big data, etc.) has the potential to replace the traditional process of information flow and system automation, thereby completely transforming and automating the accounting information and audit process. The accounting and auditing professions will be accompanied by a convergence and synergy with new technologies, a transformation in the style of administrative systems and bureaucracy, and we will witness accounting and auditing with stability, integrity, continuity, and online and in real time. This will be in accordance with the theoretical concepts of financial reporting, accounting and auditing standards, laws and regulations, and the needs of society.

The results of the literature analysis and research findings as a theoretical framework indicated that automated accounting and auditing on the blockchain platform is a set of processes, tools, emotions, feelings, beliefs, attitudes, motives, conditions, values, importance, necessity, dependence, preferences, personal, social, economic, political, contextual factors, and professional principles in finance, accounting, and auditing related to blockchain technology in the past, present, and future.

The fundamental factor that drives the growth and expansion of any profession, including accounting and auditing, is a commitment to a code of professional ethics. In light of these considerations, it is clear that the ethical implications of blockchain technology are also relevant to the fields of accounting and auditing. The fundamental principles of ethics and professional conduct are set forth in various statements by the International Federation of Accountants (IFAC) and other esteemed accounting organizations, though the specific terminology may vary. Nevertheless, the fundamental concept is consistent across all of these definitions. The aforementioned principles are applicable to all professional accountants and are as follows: The following six principles serve as the foundation for the ethical conduct of accountants: integrity, impartiality, competence and professional care, confidentiality, professional behavior, and professional principles and rules. The blockchain architecture allows for the straightforward fulfillment of numerous approved accounting professional ethics standards. The evidence presented herein demonstrates that the blockchain platform is capable of encompassing accounting principles and ethical standards.

The blockchain platform is distinguished by a number of key features, including decentralization, distributed databases, distributed ledgers, peer-to-peer communication, and synchronous networks. These characteristics are consistent with the principles of automated accounting and auditing. These features facilitate transparency, justice, fairness, and equality by eliminating or reducing ambiguity, doubt, conservatism, secrecy, information asymmetry, a lack of conflict of interest, and providing access to stakeholders. This access is based on ethical and human principles in all fields of knowledge, including accounting and auditing. The elimination of intermediaries, authentication of persons, direct detection of transactions, immediate registration of events, robust logic and algorithms, objectivity, network integrity, irreversibility of transactions, immutability of documents, verifiability, traceability, and completeness of information are additional features of the blockchain platform that facilitate compliance. The ethical principles that underpin the practice of this profession are as follows: integrity, honesty, impartiality, independence, competence, professional care, professional behavior, and the reduction of moral risk. These principles engender trust and reassurance in the public. In addition, the platform incorporates a number of other features, including blockchain cloud storage, cyber security,

information security and privacy with differentiated access, system integrity, non-repudiation, ownership verification, smart contracts, cryptography, tamper resistance, distributed information, consensus mechanisms, and control consolidation. The blockchain provides a mechanism for ensuring compliance with the principles of care and confidentiality, thereby offering a secure environment for beneficiaries. The most advanced technologies, including artificial intelligence, big data, internet of things, and cloud processing, are employed in conjunction with the unique features of the blockchain. This enables the collection, processing, recording, and reporting of information with the utmost precision and quality, due to the combination of blockchain algorithms and meticulous logical calculations. Furthermore, the blockchain necessitates a specific comprehension and awareness, given its elevated throughput and transformation capabilities. Consequently, accountants and auditors are required to obtain the necessary knowledge and enhance their professional abilities with regard to digital transformation. In order to fulfill the primary objective of accounting and auditing, which is to assist stakeholders in decision-making, it is imperative that these professions remain informed of the latest developments in the business world. This is in accordance with the professional principles that govern their practice, allowing them to identify and address any deficiencies in their operational capabilities and analytical abilities, thereby fulfilling their expanded responsibilities. This case study illustrates the ethical principles of competence, care, integrity, and professional conduct in accounting.

Although the contemporary world is familiar with change and transformation, the liberation from a traditional approach that has been woven into the fabric of the economic, political, cultural, and social information systems of societies for many years has brought with it an educational and knowledge approach. This is not a simple matter. Based on this, examining the various aspects of this transformative issue is a necessity in the current sensitive times. This issue can be an important suggestion for future research.

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RESEARCH ARTICLE   **Open Access**

Presenting a Model to Investigate the Impact of Intangible Capitals Management on Credit Scoring of Companies Considering the Role of Risk Management Framework, Communication and Performance

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Abstract

In today's global business environment, the concept of "Intangible Capital" has become a crucial tool for enhancing both the value and credibility of firms. Intangible capital encompasses non-physical assets such as intellectual capital, intellectual property, brand reputation, and employee skills, all of which play a vital role in economic growth and organizational performance. This research aims to provide a comprehensive evaluation of the impact of intangible capital on various dimensions of credit profile, including qualitative, quantitative, intellectual, and investment indicators. Additionally, the study explores the mediating role of company performance and the moderating role of risk management frameworks and political connections. To achieve this, the research employs Partial Least Squares Structural Equation Modeling (PLS-SEM), a robust approach that facilitates a detailed analysis of the complex relationships among the variables. Data were collected through surveys, enabling a quantitative assessment of the impacts and interdependencies. The findings reveal that intangible capital has a positive and significant effect on the different dimensions of credit profile.
Keywords: intangible capital, credit scoring, performance, risk management framework and political communication.
Jel: E22, E51, L25, G32, P33

Introduction

Intangible assets, including intellectual capital, brand value, and intellectual property, can significantly influence credit scoring. These assets often serve as indicators of a company's potential and stability in generating future profits, directly impacting how creditors assess its creditworthiness. A strong base of intangible capital may signal lower risk, thereby improving a company's credit score. Firms endowed with substantial intangible assets are less likely to default, as these assets contribute to stable cash flows and help maintain and enhance competitive advantages (Amat et al., 2017). Moreover,

intangible assets can profoundly impact company performance in various ways. For instance, innovation, research, and development can lead to the creation of new technologies and products, improving a company's performance over time. A strong brand can significantly bolster financial and market performance by increasing customer loyalty and enabling superior pricing strategies (Tahat et al., 2018). Additionally, the skills, experience, and knowledge of a company's workforce—collectively known as human capital—are vital for operational excellence and innovation. Effective and unique organizational processes can become valuable sources of competitive advantage,

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further enhancing firm performance (Hazan et al., 2021).

Political connections can influence the qualitative aspects of credit scoring, affecting the cost of debt and financial stability. In the context of intangible assets like reputation and relationships, political connections may enhance the perceived credibility of a company. Conversely, a robust risk management framework is essential for effective credit risk assessment. Research suggests that efficient internal controls and risk management practices can significantly reduce credit risk, a critical factor in credit evaluations (Akwaa-Sekyi et al., 2017).

Despite the increasing prominence of intangible assets, there remains a significant gap in the literature regarding their comprehensive impact on credit scoring, particularly in the presence of moderating and mediating variables such as company performance, risk management frameworks, and political connections. Existing studies tend to focus on individual components of intangible assets, often neglecting the interplay between these factors and their combined effect on creditworthiness. Moreover, while the significance of risk management frameworks in improving financial stability is widely recognized, little attention has been given to their moderating role in the relationship between intangible assets and credit profiles. Similarly, political connections, which can provide firms with access to resources and regulatory advantages, may also introduce inefficiencies, highlighting the need for a nuanced understanding of their impact within this context.

This study aims to address these gaps by developing a comprehensive model to assess the impact of intangible assets on the credit scoring of companies listed on the Tehran Securities Exchange. The research seeks to systematically evaluate how intangible assets influence different dimensions of credit profiles, including qualitative, quantitative, intelligence, and capital indicators. Additionally, it examines the mediating role of company performance, which represents

the operational and financial outcomes driven by intangible investments, and the moderating roles of risk management frameworks and political connections. By integrating these variables, the proposed model captures the multifaceted relationships that shape a company's creditworthiness.

The findings of this research are expected to make significant contributions both theoretically and practically. From a theoretical perspective, the study enriches the existing body of knowledge by providing a holistic framework that incorporates the interplay of intangible assets, company performance, and external moderating factors. Practically, the results will offer actionable insights for corporate managers, enabling them to strategically invest in intangible assets, implement robust risk management protocols, and leverage political connections effectively to enhance their credit profiles. Furthermore, these findings can guide policymakers in designing regulatory frameworks that promote transparency and fair evaluation of intangible assets in credit assessments, ensuring a more sustainable and competitive financial ecosystem.

Theoretical foundations and research background
Theoretical foundations

Intangible capitals have become an integral part of companies' assets, particularly over the past three decades. Their definition stems from their distinction from physical capital, characterized by their "absence of physical presence" or "intangibility" (Alsamawi et al., 2020). From another perspective, the lack of physical presence makes it more challenging to establish and protect ownership of intangible assets, which can often be replicated, typically through electronic or verbal means, by reiterating ideas or data without physical possession. As a result, intangible assets often receive special protections through intellectual property rights, trademark laws, and non-compete clauses (Crouzet et al., 2022).

Although credit itself is as old as business, the history of credit scoring is relatively brief, spanning only six decades. In response to the exponential growth in credit demand, financial institutions have developed automated credit risk assessment systems, employing various methods to evaluate customers (Abdou and Pointon, 2011). Today, credit risk has become one of the most critical issues in the banking industry. While this risk cannot be entirely eliminated in practice, understanding its causes can help mitigate it as much as possible (Salari et al., 2019). Credit assessments typically involve comparing the applicant's characteristics with those of previous applicants who received credit and successfully repaid it. This comparison forms the basis of an automatic system that facilitates credit granting decisions with high accuracy, thus reducing the likelihood of defaults (Blochlinger and Lippold, 2006). The primary principle behind credit assessment is to evaluate an applicant's profile against historical data of borrowers who demonstrated the ability to repay their debts (Amat et al., 2016).

Performance is defined as the effectiveness and efficiency with which Intelligent Automation technologies enhance the execution of knowledge-based and service-oriented tasks. This includes improvements in speed, accuracy, overall productivity, and the capacity to handle complex cognitive tasks that traditionally required human intervention. Intelligent Automation not only streamlines repetitive tasks but also significantly contributes to strategic business value by optimizing processes and enabling more informed decision-making (Coombs et al., 2020).

An effective risk management framework is vital for balancing risk acceptance and reduction, thereby creating value for an organization. By implementing a structured approach, companies can ensure alignment with international standards and best practices, helping minimize the impact of potential risks (Blair et al., 2024). Additionally, risk management aims to mitigate the adverse effects of activities through proactive measures, forecasting potential issues, and planning strategies to avoid them (Sadri et al., 2024).

Political connections can significantly enhance a company's market capitalization and access to resources, providing a competitive advantage. Research suggests that while political connections can improve performance, they may also introduce inefficiencies, particularly in state-owned enterprises, due to political interference. In general, political connections, when managed effectively, can serve as valuable assets for improving corporate financial performance (Prasetyo and Nasution, 2022).

2-2- Research background

Temba et al. (2024) examined the influence of credit risk management (CRM) approaches on the financial performance of commercial banks in Tanzania. Their findings indicated that risk assessment and approval processes, the quality of credit processes and controls, the adequacy of recovery procedures, and risk monitoring through capital adequacy, efficient use of equity, and asset quality all positively affected banks' performance. In another study, Ahadi Serkani et al. (2022) explored the complex relationships between fraud, financial management decisions, and the factors that influence these dynamics using Structural Equation Modeling (SEM). They developed a comprehensive model to understand how fraud influences financial management decisions, highlighting the critical roles of trust and political communication in this context. Paidar et al. (2021) aimed to prioritize the dimensions, components, and indicators of the intellectual capital model in state-owned banks using the competency approach of managers. This study provided a structured model for enhancing intellectual capital in state banks by focusing on the most critical dimensions and indicators, guided by the competencies of their managers. Sadeghnia and Setayesh (2020) investigated the impact of integrating information systems (IS) on the financial performance of companies listed on the Tehran Stock Exchange (TSE), considering

the mediating roles of performance. They highlighted the importance of integrating information systems to achieve better financial outcomes through improved cost management and quality performance.

Jory et al. (2020) examined the relationship between government economic policy uncertainty (EPU) and its implications for trade credit policies and firm value among U.S. public companies. They provided valuable insights into how firms adjust their financial strategies in response to economic policy uncertainty and the complex effects of these adjustments on their overall value. In another study, Tahat et al. (2018) investigated the impact of intangible assets on the financial and market performance of companies. Supporting both market-based and resource-based theories, they suggested that investments in intangible assets are crucial for long-term wealth creation. Yilmaz (2018) examined the prevalence and influence of companies connected to political figures or institutions and found that, while political communication can benefit companies, it is influenced by the regulatory environment and the overall transparency of the economic system. Amat et al. (2017) presented a study that applied a credit scoring model to help financial institutions evaluate credit applications, emphasizing the social implications of a reliable credit scoring system, which can increase trust in financial institutions' assessments, especially after financial crises.

Additionally, Chan et al. (2011) explored the relationship between financial distress and its determinants. They identified a significant positive relationship between company size and financial distress, a positive relationship between the interest coverage ratio and financial distress, and a negative relationship between operating profit growth and financial distress. Furthermore, Jarrow and Turnbull (2000) studied the intricate relationship between market risk and credit risk, highlighting that these risks are inherently related and cannot be fully separated. They outlined two primary methods for pricing credit risk instruments:

the structural approach and the reduced-form approach.

Hypothesis development and Conceptual model

This section first examines the accuracy and validity of the relationships between the research variables, which form the basis for the hypotheses presented in the "Hypothesis Development" section. Next, we will detail the dimensions of the research variables and introduce the articles and sources used in designing the questionnaire. Finally, the conceptual model of the research will be presented in the form of a diagram.

Hypothesis development
The impact of Intangible capitals on performance:

Intangible capitals have been shown to significantly influence a firm's performance by enhancing its financial stability and reducing default risk. Investments in intangible assets drive productivity growth, although studies highlight that intangible asset face greater financial constraints due to informational asymmetries and difficulties in valuing collateral, often relying more on internal financing. An empirical analysis conducted across 32 countries and 30 industries from 1990 to 2014 revealed that financial development significantly impacts labor productivity, particularly in sectors reliant on intangible assets. Policies that enhance financial structures, promote competition, and strengthen legal frameworks can alleviate financial constraints, thereby boosting productivity in these sectors (Demmou et al., 2019).

The impact of Performance on the relationship between intangible capitals and firm value:

Financial performance influences firm value through intellectual capital disclosure, meaning firms with strong financial performance are more likely to disclose their intellectual capital, which in turn enhances their overall firm value. This disclosure acts as a mediator, legitimizing the firm's success

and providing a competitive edge. By transparently sharing information about their intellectual assets, companies can improve investor confidence, reduce information asymmetry, and ultimately achieve higher market valuations (Keter et al., 2024).

The effect of Risk management framework on the relationship between intangible assets and credit profile:

The Institute of Internal Auditors (2020) presented a comprehensive framework for internal auditors to evaluate the effectiveness of their organization's credit risk management processes. The study indicated that risk management affects several key variables, including the stability and predictability of financial outcomes, the likelihood of adverse events, and overall financial performance. Effective risk management practices help mitigate financial losses and operational disruptions, thereby enhancing the firm's credit rating and access to capital.

The effect of Risk management framework on the relationship between intangible assets and credit profile:

A study in Indonesia revealed a positive and significant relationship between intellectual capital and firm performance. Firms with higher levels of intellectual capital, such as human, structural, and relational capital, tend to perform better financially. The study also explored the moderating role of political connections in this relationship. Companies with strong political ties are better positioned to leverage their intellectual assets, gaining advantages such as easier access to resources, favorable regulations, and enhanced market opportunities (Cahyono & Ardianto, 2024).

Combination of research variables

The composition and factors of the research variables are presented in the following table:

Table 1.

Combination of research variables

latent variables	observed variables	researcher (date)
Intangible Capitals	Intellectual Capitals	Pulic (2000)
	Other Intangible Assets	John F. Tomer (2008)
Credit Profile	Quality Indicators	Erzae et al. (1396)
	Intelligence Indicators	Tjøstheim & Stephens (2022)
	Quantitative Indicators	Erzae et al. (1396)
	Capital Indicators	Nhan Huynh et al. (2024)
Company Performance	Control and Evaluation	Shobhit Seth (2024)
	Confusion and Financial Fantasies	
	Resilience	
	Development Strategies	
Risk Management Framework	Risk governance	David Kindness (2024)
	Risk reporting and monitoring	
	Risk reduction	
	Risk measurement and assessment	
	Risk identification	
Political Connections	Power Liquidity	Al-dhamari & Ku Ismail (2015)
	Political Influence	
	Dependence of board members on power	

Conceptual model

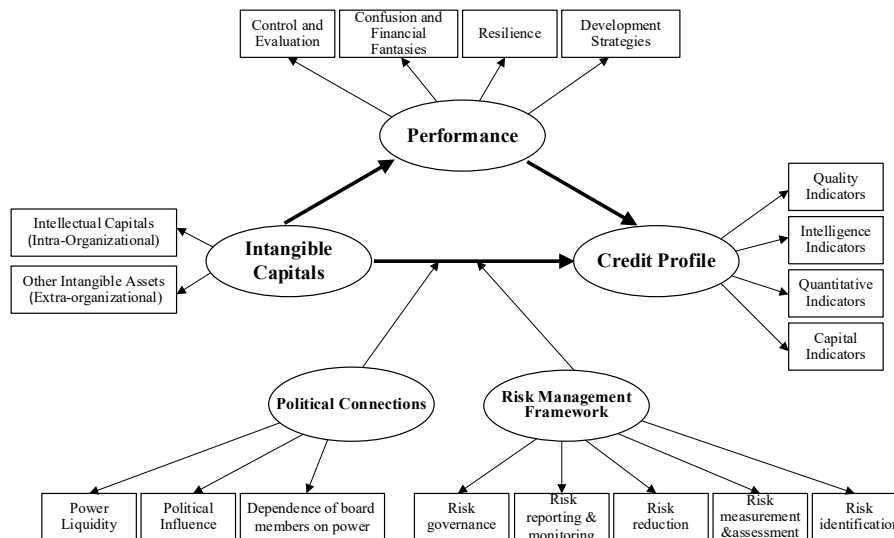Therefore, the conceptual model can form as follow:

Figure 1. *Relationship of research variables based on structural equation model*

Methodology

The present study is applied research in terms of orientation, field research in terms of history, a survey in terms of data collection, and quantitative in terms of methodology. It is also correlational, as it measures the relationships between variables, and cross-sectional in terms of data collection time. The study aims to propose a comprehensive model of the impacts of intangible capitals on the credit scoring of companies listed on the Tehran Securities Exchange. It explores these impacts, including moderating and mediating factors, through a survey approach. Data were collected using questionnaires.

The statistical population of the research consists of 378 respondents, selected from managing directors and board members of listed companies, academic faculty members in economics and finance, heads, deputies, and specialists from credit units working in private banks, as well as financial managers and experts. The sample size was determined using Cohen's sampling method.

In addition, a literature review and theoretical foundations were utilized to identify intangible capitals in credit scoring for companies listed on the Tehran Securities Exchange. The study also examines the effect of two categories of moderating and mediating variables—namely, the risk management framework, political communication, and company performance—on the relationship between intangible capitals and credit assessment.

Hypotheses were tested using questionnaire data, localized based on the financial structures and capacities of the companies under study. The questionnaire was designed based on the assumptions and questionnaires from valid articles and expert opinions. Validity and reliability of the questionnaire were also evaluated. Data analysis was performed using path analysis with the PLS-SEM method, utilizing Smart-PLS 4.1.0.6 software for data processing. The questionnaire included multiple-choice questions, with the exception of those related to the respondent's identity, which were semi-open. Each multiple-choice question offered five answer options on a Likert scale: strongly agree (5 points), agree (4 points), neutral (3 points), disagree (2 points), and strongly disagree (1 point). Data processing was conducted using PLS and Smart-PLS 4.1.0.6 software.

Research Findings
Demographics

A total of 378 participants took part in the study, consisting of 306 males (80.96%) and 72 females (19.04%), with men representing the majority of respondents. Regarding educational qualifications, 11.90% of respondents held a bachelor's degree, 37.31% had a Ph.D., and the majority, 50.79%, held a master's degree. In terms of occupational

classification, the respondents were predominantly from three categories: "financial institutions" (43.65%), "banks" (18.25%), and "stock exchange" (14.29%).

Descriptive Analysis

In this section, we present the descriptive statistics of the variables based on data extracted from the questionnaires. As shown in Table 1, "intangible capitals" has the highest average value among the research variables, with a mean of 4.241, while the lowest average is associated with political connections, with a mean of 3.827.

Table 2.
Descriptive statistics of variables

Variable	Mean	Quart. 1	Median	Quart. 3	Standard Deviation	Skewness
Credit Profile	(0.007)	4	0.024	5	0.613	(0.250)
Intangible Capitals	0.000	4	0.015	5	0.576	0.000
Performance	0.000	4	(0.019)	5	0.712	0.066
Political Connections	0.000	4	(0.002)	4	0.911	(0.530)
RMF	0.000	4	0.058	5	0.773	(0.604)

Reliability of the model

In this step, two indicators are used to check the reliability of the model: the composite reliability criterion (CR) and Cronbach's alpha coefficient criterion. Cronbach's alpha is a classic indicator for reliability analysis that provides an estimate of reliability based on the internal correlation of items, with an appropriate value being greater than 0.7. The composite reliability criterion (CR) has advantages over the Cronbach's alpha method. Its superiority lies in the fact that the reliability of structures is not calculated in absolute terms but according to the correlation of their structures with each other. Additionally, for its calculation, indicators with higher outer loading are more important. In general, both of these criteria are used to better measure the reliability of the model.

Composite reliability (CR)

This criterion was introduced by Werts et al. (1974). If the composite reliability value for each construct is higher than 0.7, it indicates appropriate internal reliability for measurement models, while a value less than 0.6 indicates the absence of reliability (Nunnally, 1987). It is important to mention that composite reliability in structural modeling is considered a better measure than Cronbach's alpha because, in calculating

Cronbach's alpha coefficient for each construct, all indicators are included in the calculations with equal importance. In contrast, for calculating composite reliability, indicators with higher outer loading are more important. The reported composite reliability value for each of the hidden constructs of the research model is as described in the following table:

Table 3.
Composite reliability values

Variable	Composite reliability
Credit Profile	0.879
Intangible Capitals	0.865
Performance	0.840
Political Connections	0.850
Risk Management Framework	0.862

Cronbach's alpha coefficient

Cronbach's alpha coefficient is a factor whose value ranges from 0 to 1, with a value higher than 0.7 indicating acceptable reliability (Cronbach, 1951). However, Moss et al. (1998) have introduced a value of 0.6 as the threshold for Cronbach's alpha coefficient in the case of variables with a small number of questions. In the table below, the value of this coefficient is estimated for each of the factors:

Table 4.
Cronbach's alpha values

Variable	Cronbach's alpha
Credit Profile	0.816
Intangible Capitals	0.701
Performance	0.748
Political Connections	0.738
Risk Management Framework	0.800

According to the table above, the Cronbach's alpha coefficient for all the desired structures is higher than 0.7, which indicates the appropriate reliability of the model.

Validity

To check validity, two criteria of "convergent validity" and "divergent validity" are used as follows.

Convergent validity

Convergent validity examines the degree of correlation between each construct and its questions (indices). The higher the correlation, the more favorable the fit. One common measure to establish convergent validity at the construct level is the average variance extracted (AVE). An AVE value greater than or equal to 0.5 indicates that, on average, the structure explains more than half of the variance of the corresponding indicators. If AVE is less than 0.5, it indicates that, on average, there is more error in the items relative to the variance explained by the constructs (Gefen and Straub, 2005). The table below presents the value of this coefficient for each of the structures.

Table 5.
Average extracted variance values

Variable	AVE
Credit Profile	0.645
Intangible Capitals	0.761
Performance	0.569
Political Connections	0.654
Risk Management Framework	0.559

Divergent validity - Fornell-Larcker criterion

To check the divergent validity of the measurement model, the Fornell-Larcker criterion is used. According to this criterion, acceptable divergent validity of a model indicates that a construct in the model interacts more with its indicators than with other constructs. According to Fornell and Larcker (1981), divergent validity is at an acceptable level when the AVE for each construct is greater than the shared variance between that construct and other constructs in the model. Divergent validity is the third criterion for examining the fit of measurement models, addressing two issues:

1. Comparing the degree of correlation between the indicators of a structure with that structure versus the correlation of those indicators with other structures.
2. Comparing the correlation of a structure with its indicators versus the correlation of that structure with other structures

In Smart-PLS software, this is checked using a matrix that contains the values of correlation coefficients between constructs and the square root of AVE values for each construct. The model has acceptable divergent validity if the numbers included in the main diagonal are greater than their underlying values (Davari and Rezazadeh, 2013). The values on the main diagonal of the matrix are replaced with the square root of the variance values described in AVE, and the following table is presented.

Table 6.
Fornell and Larcker after placing the square root values of AVE

Variable	Political Connections	Intangible Capitals	Performance	Credit Profile	RMF
Political Connections	0.809				
Intangible Capitals	0.383	0.873			
Performance	0.518	0.701	0.754		
Credit Profile	0.629	0.570	0.691	0.803	
RMF	0.516	0.651	0.753	0.718	0.747

Inferential Analysis

Conventional models in structural modeling consist of two parts: measurement models, which show how the latent variables are explained, and structural models, which show how the latent variables are linked to each other. Measurement models specify the relationships between indicators (observed variables) of a construct (latent variable) and that construct. The review of the research model is done in three stages. In the first step, the outer model of the research is examined. In the second stage, the inner model is examined, and the third stage is devoted to the examination of the overall research model.

Evaluation of the model (outer model)- Outer loadings of the dimensions of variables

To evaluate the structural equation models, we first evaluate the outer model. In this evaluation, the relationship between indicators (observed variables) and latent variables (hidden) is analyzed through calculated outer loadings. In this step, the outer loadings related to the measured indicators of each variable are examined. Outer loadings higher than 0.4 are desirable, and indicators with outer loadings lower than 0.4 should be removed. Ideally, outer loading values should be more than 0.7, but values in the range of 0.4 to 0.7 are also acceptable. The initial outer loading model is as follows:
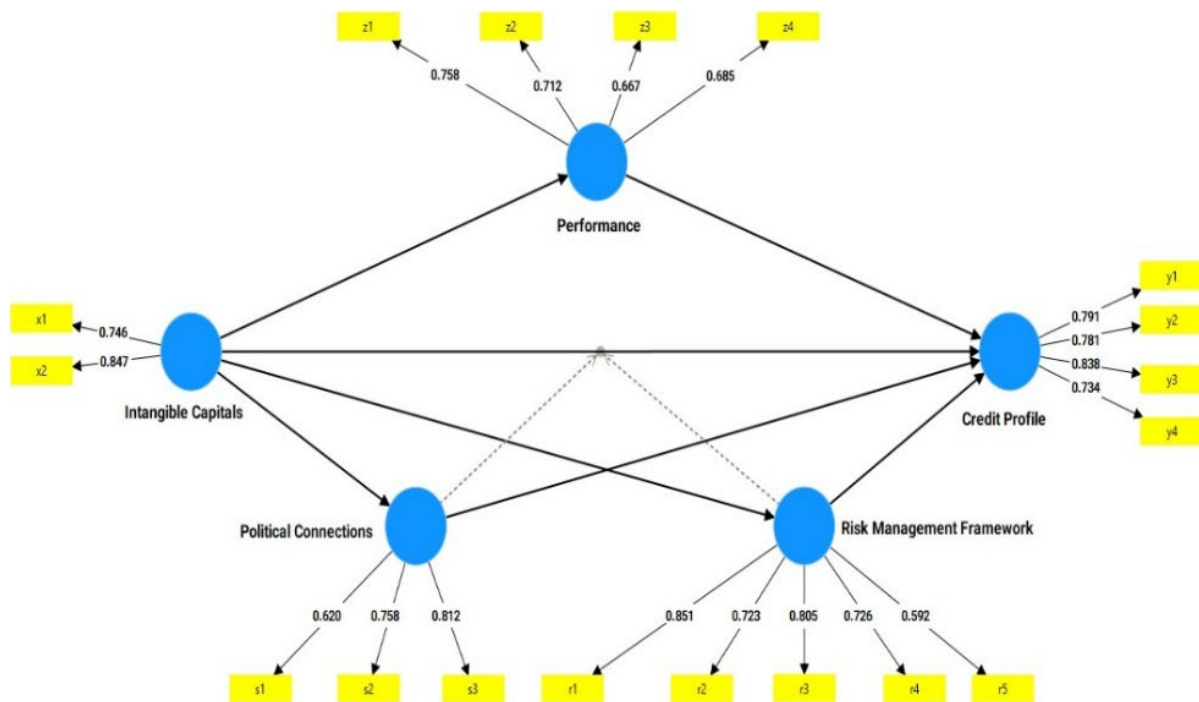
Figure 2. *Model for measuring outer loadings (outer model)*

Evaluation of the structural model (inner model):

Here, we examine the relationship between latent variables through the path coefficients. The coefficients of the structural model can be compared to each other. If the path coefficient of one structure is larger than the other one, it indicates a greater effect on the endogenous structure. Path coefficients have standardized values between -1 and +1; If the estimated path coefficients are close to +1, it indicates a positive relationship between two constructs, and if they are close to -1, it indicates a negative relationship between the two constructs. It is also possible to evaluate the direct effects and indirect effects that are applied by means of mediating structures.
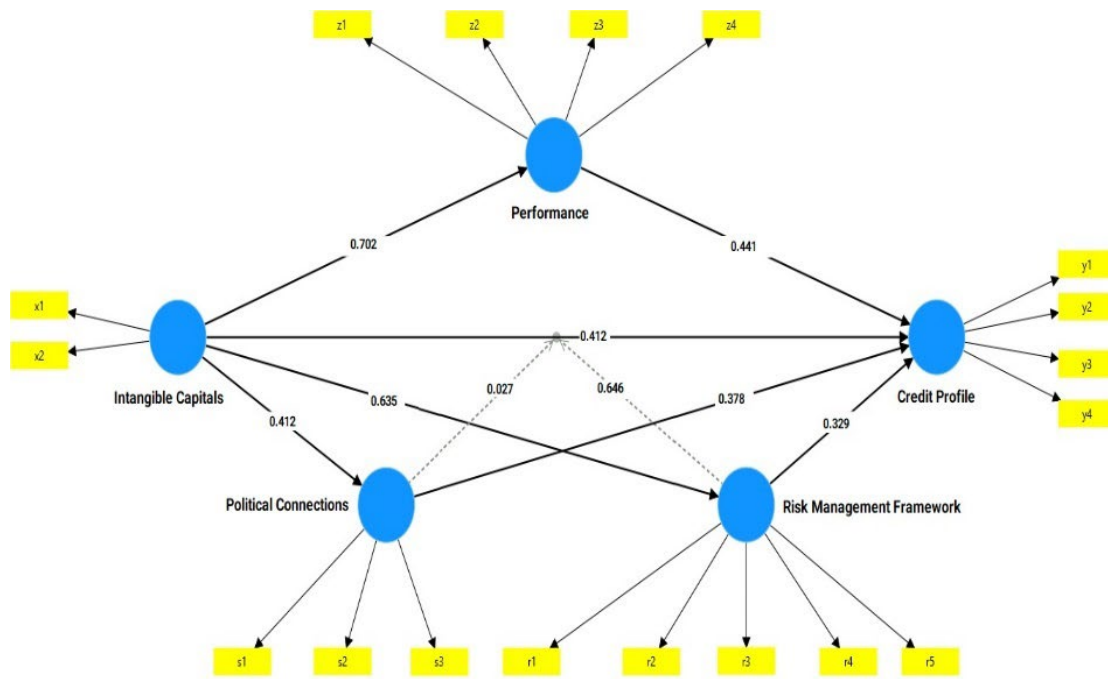
Figure 3. *Path coefficients measurement model (inner model)*

In this figure, intangible capitals and credit profile have a direct relationship with the severity of 0.412; But there is another indirect relationship through the performance of the company, which is calculated from the multiplication of two effects of 0.702 and 0.441, i.e., 0.310. To calculate the total effect of intangible capitals on the credit profile, the sum of two direct and indirect effects, i.e., 0.722=0.310+0.412, should be considered. Although the direct effect of intangible capitals on the credit profile is not very strong, its total effect is relatively significant considering the mediating variable.

T-student test

In this section, significant coefficients are extracted based on t-student (t-values). Since according to the table below, the t-values for the claim made in this research are more than 1.96, therefore, their significance is confirmed at the confidence level of 95%.

Table 7.
t-student (t-values)

Relation between Variables	T statistics (O/STDEV)
Political Connections → Credit Profile	5.428
Intangible Capitals → Political Connections	5.55
Intangible Capitals → Performance	17.804
Intangible Capitals → Credit Profile	1.966
Intangible Capitals → Risk Management Framework	13.346
Performance → Credit Profile	1.957
Risk Management Framework → Credit Profile	3.16

Coefficient of Determination

The coefficient of determination is a number between 0 and 1 that measures how well a statistical model predicts an outcome. In other words, it is a statistical measurement that examines how differences in one variable can be explained by differences in a second variable when predicting the outcome of a given event. Calculating it allows us to determine how confident we can be in the model. The important point is that the value of the coefficient of determination is calculated only for the dependent (endogenous) variables of the model; for

exogenous factors, the value of this criterion is zero. The higher the value of the coefficient of determination related to the endogenous structures of a model, the better the fit of the model. Chin (1998) considers three values - 0.19, 0.33, and 0.67- as criteria for weak, medium, and strong values of the fit of the structural part of the model, respectively, by means of the coefficient of determination criterion.

Table 8.
Coefficient of determination of the model

Variable	R^2
Model	0.423

Predictive quality (Q^2)

The second indicator of the predictive power of the model is the predictive quality index, or Q^2. This criterion, introduced by Stone and Geisser (1975), determines the predictive power of the model in endogenous constructs. They believed that models with acceptable structural fit should be able to predict the endogenous variables of the model. This means that if the relationships between the structures are correctly defined in a model, the structures have a sufficient impact on each other, thereby correctly confirming the hypotheses. The blindfolding technique is used to calculate the Q^2 index in Smart-PLS software (Chin, 1998). This measure determines the predictive power of the model. Models with an acceptable structural fit should be able to predict indicators related to the endogenous constructs of the model. Henseler et al. (2009) proposed three values -0.02, 0.15 and 0.35- to indicate the weak, medium, and strong predictive power of the structure or endogenous structures of the model with reflective indicators (Davari and Rezazadeh, 2013).

Table 9.
Prediction quality of the model

Variable	Q^2
Model	0.357

Goodness of Fit criterion

The Goodness of Fit (GOF) criterion is developed as a general measure of model fit for structural equation models. Wetzels et al. (2009) introduced three values of 0.01, 0.25, and 0.36 as weak, medium, and strong values for GOF, respectively.

Table 10.
The average geometric mean of the coefficient of multiple determination of the model

Variable	GOF
Model	0.388

According to the obtained value of GOF in Table 8 as 0.388, the good fit of the model is confirmed.

Structural equation model fit

This research focuses on data analysis using inferential statistics methods, considering the following hypotheses. The hypotheses are designed to explain the main research question: "How to represent a comprehensive model of the impacts of intangible capitals on the credit scoring of companies listed on the Tehran Securities Exchange?"

H₁: *"intangible capitals" has a significant impact on "credit profile".*

Table 10 provides the path analysis results of H₁:

Table 11.
The result of H₁

Path	Path Coefficient	Result
Intangible Capitals → Credit Profile	0.412	Supported
Significance level 5%		
Source: research findings		

According to the table above, the value of the path coefficient is 0.412, indicating a significant relationship. Additionally, the t-value obtained in Table 6 is 1.966, which, when compared with the significance level of α=0.05, confirms that this relationship is significant. In general, it can be said that the

first hypothesis is supported at a significance level of 0.05.

H₂: *"Performance" significantly mediates the relationship between "intangible capitals" and "credit profile".*

Table 11 reports the path analysis of H₂:

Table 12.
The result of H₂

Sobel statistic	Result
2.275	Supported
Significance level 5%	
Source: research findings	

According to Table 11 and the Sobel test, the mediating variable has a significant effect (a value higher than 1.96). Additionally, the t-value obtained in Table 6 indicates a significant relationship. In general, it can be said that the mediator was found to be significant, supporting H2.

H₃: *"Risk management framework" significantly moderates the relationship between "intangible assets" and "credit profile".*

Table 12 shows the path analysis of H₃:

Table 13.
The result of H₃

Path	Path Coefficient	Result
Intangible Capitals → Credit Profile Risk Management Framework moderation	0.646	Supported
Significance level 5%		
Source: research findings		

According to the table above, the value of the path coefficient is 0.646, indicating a significant relationship. Given the t-value obtained in Table 6, which is 14.089, and comparing it with the significance level of α=0.05, this relationship is significant. Therefore, H3 is supported.

H₄: *"political connections" significantly moderates the relationship between "intangible capitals" and "credit profile".*

Table 13 provides the path analysis results of H₄:

Table 14.
The result of H₄

Path	Path Coefficient	Result
Intangible Capitals → Credit Profile Political Connections moderation	0.027	Not Supported
Significance level 5%		
Source: research findings		

According to the table above, the value of the path coefficient is 0.027, which does not indicate a significant relationship. Additionally, the t-value obtained in Table 6, which is 0.41, when compared with the significance level of α=0.05, shows that this relationship is not significant. Consequently, H4 is not supported.

Discussion and Conclusion

This study aimed to develop a comprehensive model to assess the impacts of intangible capitals on the credit scoring of companies listed on the Tehran Securities Exchange. The analysis of the model is presented in four parts: Statistical Analysis, Scientific Analysis, Managerial Insights, and Future Directions.

Statistical Analysis

To address the primary research question, a comprehensive analysis of the variables influencing the relationship between intangible capitals and credit profiles was conducted with an exploratory approach. The model was tested using structural equation modeling (SEM), based on the collected data. Four partial hypotheses were examined within this framework.

The analysis of the main hypothesis revealed a significant impact of intangible capitals on the credit profile, with a direct path coefficient of 0.412 and a t-value of 1.966. This supports the view that intangible capitals play a substantial role in shaping a company's creditworthiness. According to the second hypothesis, the company's performance acts as a significant mediator in the relationship between intangible capitals and credit profiles, as confirmed by a Sobel

statistic of 2.275. The third hypothesis, which examines the moderating effect of the risk management framework, also found significant results, indicating that a strong risk management system strengthens the relationship between intangible capitals and credit profiles. However, the fourth hypothesis, which postulated that political communication moderates this relationship, was not supported. The path coefficient for political communication was 0.027, and the t-value was 0.41, which is not statistically significant.

Scientific Analysis

The research findings suggest that investments in intangible assets positively affect both current and future financial performance. These assets help firms adapt to dynamic market conditions, contributing to sustained growth and a competitive advantage. Furthermore, a robust risk management framework is essential for enhancing a firm's financial stability and creditworthiness. By systematically identifying, assessing, and mitigating risks, firms can protect their capital and earnings, leading to more stable and predictable financial outcomes. Companies with effective risk management practices are likely to experience higher performance metrics, such as return on assets (ROA) and return on equity (ROE).

From a scientific perspective, this study affirms that incorporating mediating and moderating variables is crucial for understanding the complex dynamics between intangible capitals and credit profiles. The research confirms that performance significantly mediates the relationship between intangible capitals and credit profiles. Additionally, the moderating effect of the risk management framework aligns with expectations, underscoring the importance of risk governance in shaping the creditworthiness of firms. However, the expected moderating effect of political communication was not supported by the data.

To further explain these relationships, the performance component of "control and evaluation" showed the strongest relationship with the credit profile, suggesting its key role in linking intangible capitals to credit scores. In terms of political communication, the component "the dependence of board members on power" better explains the influence of political ties on the relationship between intangible capitals and credit scoring. Among the elements of the risk management framework, "risk governance" was identified as the most influential factor in mediating the relationship between intangible capitals and credit profiles.

Additionally, this study operationalized the impact of intangible capitals on four components of a company's credit profile: the quantitative index, qualitative index, intelligence index, and capital index, while accounting for the roles of mediating and moderating variables.

Managerial Insight

The article provided a managerial perspective on the relationship between intangible capitals and company credit scoring and underscored the critical role in which, intangible assets play in enhancing a company's credibility and stability, influencing key indicators such as performance, risk assessment, and overall credit profile. Notably, the article emphasized the importance of a robust risk management framework and political connections and suggested that while intangible assets significantly contribute to firm stability and creditworthiness, the presence of a strong risk management framework can substantially moderate this relationship, thereby enhancing the reliability of credit assessments. Furthermore, the findings offered practical guidance for managers aiming to improve their company's creditworthiness. By investing in intangible assets and strengthening risk management protocols, companies can enhance their competitive edge, reduce borrowing costs, and improve access to capital. This approach also involves leveraging performance as a mediating factor

to enhance credit profile. In the following, 7 approaches are recommended for managers to use:

Approach 1: Leveraging Intangible Capitals for Enhanced Credit Scoring

Managers should recognize the strategic importance of intangible capitals, in enhancing a company's credit profile. By investing in and effectively managing these non-physical assets, firms can improve their qualitative and quantitative credit indicators. Additionally, fostering a culture of continuous learning and innovation among employees can enhance intellectual capital, leading to improved operational efficiencies and competitive advantages. Managers should therefore prioritize the development and integration of intangible capitals into their overall business strategy to achieve sustainable growth and favorable credit assessments.

Approach 2: Integrating risk management framework alongside political communication and external communication strategies

The role of a robust risk management framework cannot be overstated when it comes to leveraging intangible capitals for credit scoring. Furthermore, political connections and external communication strategies should be managed carefully to protect and enhance the company's reputation. By integrating risk management with the strategic management of intangible capitals, firms can safeguard their assets, maintain operational resilience, and ultimately improve their credit profile. This holistic approach enables managers to navigate uncertainties while capitalizing on the strengths of their intangible assets.

Approach 3: Establishing Metrics for Intangible Asset Valuation

Managers should develop clear metrics to evaluate the value and impact of intangible assets on overall business performance and creditworthiness. This could involve creating key performance indicators (KPIs) that specifically measure the effectiveness of brand reputation, employee engagement, and innovation initiatives. By quantifying the contributions of intangible assets, managers can better communicate their value to stakeholders, including investors and credit rating agencies. Regularly assessing these metrics will also help in making informed decisions about where to allocate resources for maximum impact on credit profile.

Approach 4: Enhancing Stakeholder Engagement and Communication

Effective communication with stakeholders about the company's intangible assets and risk management strategies is crucial. Managers should develop a comprehensive communication plan that highlights the significance of these assets in driving business success and mitigating risks. This includes engaging with investors, customers, and employees to build a shared understanding of the company's value proposition. By fostering transparency and trust, firms can enhance their credibility and improve their overall credit assessments.

Approach 5: Fostering Innovation and Adaptability

To maintain a competitive edge, managers should cultivate a culture of innovation and adaptability within the organization. This involves encouraging employees to contribute ideas and solutions that leverage intangible assets for business growth. Managers can implement programs that reward innovative thinking and provide resources for experimentation. By staying ahead of market trends and adapting to changes, companies can enhance their intangible capital and strengthen their creditworthiness.

Approach 6: Building Strategic Partnerships

Managers should seek to establish strategic partnerships that can enhance the value of intangible assets. Collaborating with other firms, research institutions, or industry organizations can provide access to new technologies, expertise, and markets. These partnerships can amplify the impact of a company's intangible assets, such as intellectual property and brand reputation, while also sharing the risks associated with innovation and market entry. By leveraging external resources, firms can improve their competitive positioning and credit profile.

Approach 7: Conducting Regular Risk Assessments

Regular risk assessments are essential for identifying potential vulnerabilities related to intangible assets. Managers should implement a systematic approach to evaluate risks associated with intellectual property, brand reputation, and human capital. This includes assessing external threats, such as market competition and regulatory changes, as well as internal factors, such as employee turnover and operational inefficiencies. By proactively addressing these risks, managers can protect their intangible assets and enhance the company's overall creditworthiness.

By incorporating these additional approaches, managers can further strengthen their strategies for leveraging intangible assets and risk management, ultimately leading to improved credit ratings and financial stability.

Future Directions

1) Considering the prioritized dimensions of intangible capitals in this research, future studies could investigate the effect of other dimensions of intangible capitals on the credit profile of companies.

2) It is suggested that future research should explore whether other factors, apart from the mediating and moderating variables considered in this study, have an effect on this relationship and how this effect manifests.

3) It is recommended that the comprehensive model presented in this research be tested in different industries within Iran's capital market and compared with the results of this study.

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RESEARCH ARTICLE   **Open Access**

Identifying Factors Affecting Energy Waste in the Production Industry and Providing a Suitable Model for Energy Efficiency and Development of Renewable Energy in the Production Sector

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Abstract
The energy sector is a vital pillar of economic development of any country. The government and the private sector are exploring efficient energy sources, and for this purpose, various governments have specified carbon-related targets considering the existing realities. In such circumstances, manufacturing companies are under pressure to improve their energy performance. In these circumstances, reducing energy loss from production systems is very important. The aim of the present study is to identify the factors affecting energy loss in the manufacturing industry and to provide a suitable model for energy efficiency and the development of renewable energies in the manufacturing sector. The research method is mixed. The study sample consisted of 148 experts in manufacturing industries affiliated with the Electronic Industries Company in Shiraz. Data analysis was performed using pls software. The results show that reforming the infrastructure related to renewable energies, paying the initial costs of technology adoption, supporting policies, technological innovations, and inter-sectoral cooperation in technology can be solutions for the development of renewable energies in the manufacturing sector.
Keywords: Energy waste, manufacturing industries, energy efficiency, renewable energies

Introduction

Over the past 30 years, the world's GDP has grown dramatically, rising 136.03% in 2019 compared to 1990, which has caused total energy use to increase by 65.79% in the same timeframe (World Bank 2022). The share of developing economies in global energy consumption as well as energy waste, especially in the production sector, is significant. Energy losses occur during the generation, transmission and transportation of energy. These losses can have an immense impact on environmental quality. Developing economies are more susceptible to these losses due to their lack of technology in the energy sector. Furthermore, energy losses are a waste of resources, as they do not generate any output and only increase costs. Additionally, a higher share of fossil fuels in developing economies' energy resources leads to increased environmental degradation due to increased energy losses. This, in turn, leads to an increased demand for fossil fuels, energy demand, foreign dependency on energy, foreign exchange needs, and current account deficits (Naimoglu 2021; Naimoglu and Ozel 2022; Naimoglu and Akal 2022). Therefore, it is important to reduce energy losses to have a sustainable energy supply and maintain high environmental quality.

On the other hand, the integration of renewable energy solutions into the manufacturing industry is increasingly recognized as a pivotal strategy for enhancing sustainability and reducing the global carbon footprint. This transition is not only a response to the growing environmental concerns but also a strategic move to ensure

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long-term economic viability and energy security within the sector. The importance of renewable energy in manufacturing stems from the sector's substantial energy consumption and its significant impact on environmental degradation, making it a critical area for interventions aimed at mitigating climate change and promoting sustainable industrial practices (Usman et al., 2024).

Renewable energy technologies, such as solar photovoltaics, wind turbines, and biomass energy systems, offer the manufacturing industry an opportunity to decouple energy consumption from carbon emissions. Taboada et al. (2012) explored a solar photovoltaic-based energy solution for green manufacturing, highlighting the potential for renewable energy to accommodate the electricity needs of large manufacturing facilities while minimizing system costs and reducing the carbon footprint. Similarly, Xin et al. (2022) investigated the impact of renewable energy technology innovation on manufacturing carbon intensity in China, revealing significant inhibitory effects on local and neighboring carbon intensity, thereby underscoring the role of innovation in facilitating the green transformation of the manufacturing sector. Furthermore, the adoption of renewable energy in manufacturing is not without challenges. Issues such as power volatility, high initial investment costs, and the need for technological adaptation pose significant barriers to widespread adoption. However, these challenges are increasingly being addressed through policy support, technological advancements, and financial incentives aimed at enhancing the economic competitiveness of renewable energy solutions.

The transition towards renewable energy in manufacturing also presents numerous opportunities, including cost savings, improved energy efficiency, and enhanced corporate reputation. This study emphasized the strategic function of sustainability in manufacturing, advocating for optimization

of resource utilization and recovery of wastages through renewable energy use. Moreover, Kılçı (2022) examined the relationship between renewable energy use and carbon emissions in Germany and Finland, providing insights into how renewable energy policies can contribute to a more environmentally friendly future by significantly reducing carbon emissions. The integration of renewable energy solutions into the manufacturing industry is of paramount importance for achieving sustainability and reducing the carbon footprint.

The issue of energy efficiency in the manufacturing industry in Iran is considered a major challenge, and its root solution will undoubtedly be possible only through a national action with the coherence, participation, and synergy of all relevant sectors, including producers, consumers, government officials, and policymakers. In the meantime, the emergence of widespread imbalances that have gradually trapped Iran in a serious crisis in sustainable energy supply, especially in the manufacturing industry, has made increasing productivity and preventing energy waste as a national asset an unavoidable necessity (Alam Tabriz et al.,2024). However, to confront imbalances on the path to increasing productivity, there are two important points, of which the acceptance of the principle of energy waste is undoubtedly the most important. In the first stage, this will require identifying the factors affecting energy waste in the manufacturing industry. In the second step, a review of infrastructure should be put on the agenda. On the other hand, given that challenges in the areas of energy efficiency in the Iranian manufacturing industry still remain, the opportunities for innovation, cost savings, and environmental benefits are a compelling case for the transition to renewable energies. To this end, the present study, by supporting policy frameworks, technological advances, and financial mechanisms, addresses the obstacles and realizes the full potential of renewable energies in the manufacturing sector in Iran. The present study will first

identify the factors affecting energy waste in the manufacturing industry and then, based on the identified issues, will present an appropriate model of energy efficiency and renewable energy development in the manufacturing sector in order to face the problems and challenges of this sector.

Literature Review

Energy waste

"Energy waste" is not a common phrase, and there is no clear definition in manufacturing literature, while evidence identifies the important and massive potential for improving energy performance by reducing energy waste (Mardani et al., 2022). One possible reason why "energy waste" has not become a common term is that energy is physically invisible. Therefore, it is difficult to observe the energy loss. In such a situation, it is necessary to have a more accurate definition of unnecessary energy consumption, i.e. energy waste, and to understand the characteristics of energy waste more so that all stakeholders can have a comprehensive understanding of energy consumption in production.

The narrow definition of energy waste

The results of the literature review show that there are two main causes of energy waste – waste heat and the inefficient utilization of the production system.

Fig. 1. provides a simple illustration of the relationships between energy inputs, production systems, and two main causes of energy waste. Energy enters a production system as one type of resource and is consumed by machines, devices, hardware, etc. Part of the energy will be converted into heat and dissipated, normally into the air. Some measures were developed to reduce dissipated energy such as using new material to prevent heat dissipation (Pontik, 1976) or developing a new approach to detect such energy losses (Czopek et al., 2022). However, it is still impossible to avoid all the waste heat from a production system.
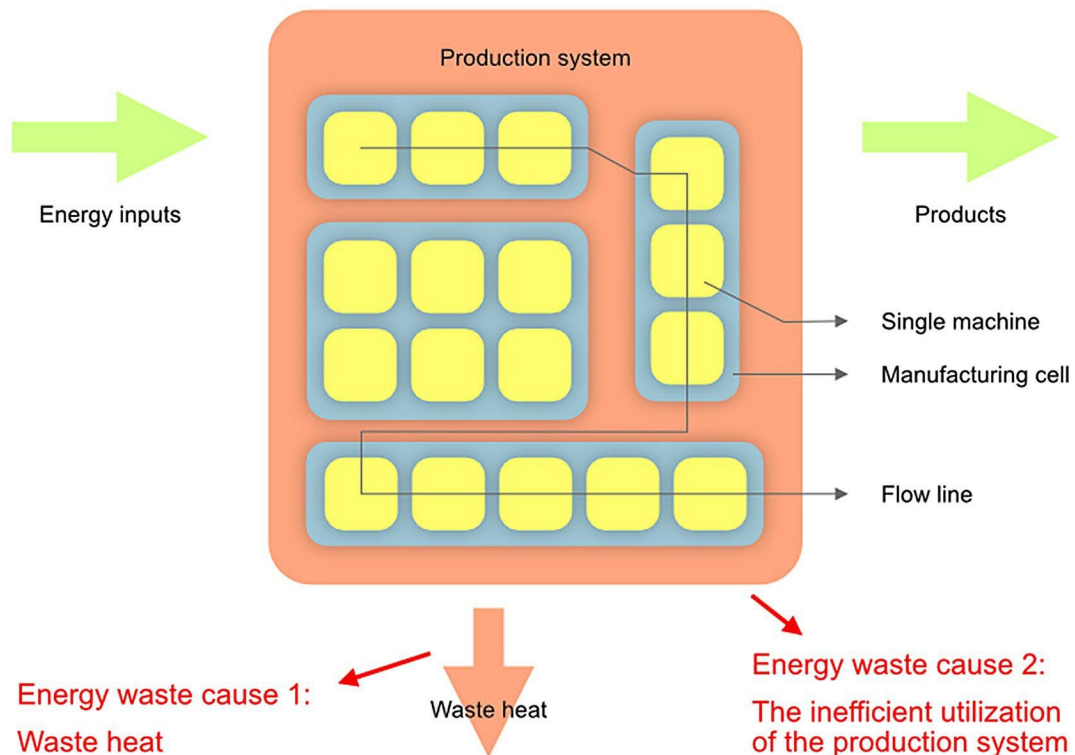
Figure1. *The relationship among two main causes of energy inputs, production systems, and two main causes of energy wastes (Geng, Evans, 2022).*

The second cause of energy waste – the inefficient utilization in the production system – is equally essential for factories to pay attention to. Based on Hon's research (2005), a production system in a factory normally has four levels (from low to high):

1) the single machine, 2) the manufacturing cell, 3) the flow line, and 4) the whole factory. Issues of wasting energy may occur at each level, covering problems like energy consumed by idle machines, inappropriate scheduling, inefficient use of production machines, etc. Previous studies revealed that different efforts have been made to solve different issues so that energy efficiency of the whole factory can be enhanced. These approaches are mainly management-based, while technologies, especially digital technologies, are essential for facilitating effective management. These technologies enable practitioners to visualise energy in the production systems so that they can apply their knowledge to removing or avoiding other types of resource wastes, i.e. material, water, etc., to energy (Yin et al., 2022).

However, few studies provide a holistic view of all the potential opportunities to save energy. However, it is important to create a concept that covers all possibilities of improving energy performance, in which energy waste is suitable in all cases. All the energy wastes should be eliminated. Based on these observations, we give a definition of energy waste as:

"Energy waste is the energy consumed above the minimum energy consumption that one production system can achieve based on the current configuration of this production system."

This definition is mainly aimed at the unnecessary operation energy consumption, which is more associated with the second cause of energy waste.

Considering that in the present study, the prevention of energy wastage in the industry has been discussed by using the development of renewable energy and solutions related to this type of energy, in the following, the literature related to renewable energy has been reviewed.

A brief history of how renewable energy has been increasingly adopted by the manufacturing industry

The adoption of renewable energy within the manufacturing industry marks a significant shift towards sustainable industrial practices, driven by the dual imperatives of environmental responsibility and economic viability. This transition has been characterized by gradual but steady progress, influenced by technological innovation, policy frameworks, and changing market dynamics. The initial foray into renewable energy by the manufacturing sector can be traced back to the energy crises of the 1970s, which underscored the vulnerabilities associated with dependence on fossil fuels. Early adopters began to explore alternative energy sources, such as solar and wind power, albeit on a small scale due to technological and economic constraints. These pioneering efforts laid the groundwork for subsequent advancements in renewable energy technologies (Breyer et al, 2022).

The turn of the century marked a pivotal moment in the integration of renewable energy into manufacturing, propelled by heightened awareness of climate change and its impacts. Governments and international bodies began to introduce policies and incentives aimed at reducing carbon emissions, which, in turn, encouraged manufacturers to reassess their energy strategies. The Kyoto Protocol, for instance, played a crucial role in promoting the adoption of renewable energy by establishing legally binding emission reduction targets for participating countries (Penna, 2019).

Technological advancements have been instrumental in accelerating the adoption of renewable energy in the manufacturing sector. Improvements in the efficiency and cost-effectiveness of solar photovoltaic (PV) panels, wind turbines, and biomass energy systems have made renewable energy a more attractive option for manufacturers. The scalability of these technologies has enabled their integration into a wide range of manufacturing processes, from small-scale operations to large industrial complexes (Kılçı, 2022).

Economic factors have also played a significant role in the adoption of renewable energy. The decreasing cost of renewable energy technologies, coupled with the

increasing volatility of fossil fuel prices, has improved the business case for renewables. Moreover, the potential for energy cost savings over the long term has made renewable energy investments more appealing to manufacturers seeking to enhance their competitiveness and resilience. Policy support has been critical in facilitating the adoption of renewable energy in the manufacturing sector. Incentives such as tax credits, subsidies, and feed-in tariffs have lowered the barriers to entry for renewable energy projects. Additionally, regulatory measures, including carbon pricing and emission trading schemes, have incentivized manufacturers to reduce their carbon footprint through renewable energy adoption (Razeghi et al, 2023). Despite the progress made, challenges remain in fully integrating renewable energy into manufacturing operations. Issues such as energy storage, grid integration, and the intermittent nature of some renewable sources continue to pose obstacles (Altin and Akay; 2024). However, ongoing research and development efforts are focused on addressing these challenges, promising to further enhance the viability of renewable energy for manufacturing.

The adoption of renewable energy by the manufacturing industry has evolved from tentative exploration to strategic implementation. This transition reflects a broader shift towards sustainability, driven by technological innovation, economic considerations, and policy support. As the industry continues to navigate the challenges and opportunities associated with renewable energy, the commitment to sustainable manufacturing practices is expected to deepen, contributing to global efforts to combat climate change (Usman et al, 2024).

Current State of Renewable Energy in Manufacturing

The integration of renewable energy into the manufacturing sector represents a critical frontier in the pursuit of sustainable industrial development. The focus on renewable energy technologies—such as solar, wind, biomass, and hydroelectric power—reflects their growing importance in reducing carbon emissions, enhancing energy security, and improving economic competitiveness within the manufacturing industry. Recent studies have underscored the increasing adoption of renewable energy sources in manufacturing due to their potential to mitigate environmental impacts and reduce dependence on fossil fuels (Dey et al, 2022; Tutak & Brodny, 2022). Solar photovoltaic (PV) systems and wind energy, in particular, have seen significant implementation across various manufacturing sectors, driven by technological advancements, decreasing costs, and supportive policy frameworks. These technologies not only contribute to the decarbonization of industrial operations but also offer resilience against energy price volatility (Fraser et al, 2023).

However, the transition to renewable energy in manufacturing is not without challenges. High initial investment costs, technological complexity, and the need for skilled workforce for installation and maintenance are among the primary barriers to wider adoption. Additionally, the intermittent nature of some renewable energy sources, such as solar and wind, poses challenges for continuous manufacturing processes, necessitating innovative solutions for energy storage and management. Policy and regulatory support play a crucial role in facilitating the integration of renewable energy into manufacturing. Incentives such as tax credits, subsidies, and feed-in tariffs have been effective in lowering the barriers to entry for renewable energy projects (Dey et al, 2022). Moreover, international agreements and national policies aimed at reducing carbon emissions have prompted manufacturers to adopt cleaner energy sources to comply with regulatory standards and meet sustainability goals.

The literature also highlights the importance of technological innovation in overcoming the challenges associated with renewable energy adoption in manufacturing. Advances in energy storage technologies, smart grids, and energy management systems are critical for ensuring the reliability and

efficiency of renewable energy sources in industrial applications. Furthermore, the integration of renewable energy with Industry 4.0 technologies, such as the Internet of Things (IoT) and artificial intelligence (AI), offers new opportunities for optimizing energy use and production processes (Hamdan et al, 2024).

The current state of renewable energy in manufacturing is characterized by rapid advancements and growing adoption, driven by the imperative for sustainability and supported by technological innovation and policy measures. Despite the challenges, the potential benefits of renewable energy for the manufacturing sector—ranging from environmental and economic to strategic—are compelling. Continued research and development, alongside supportive policies and industry engagement, are essential for realizing the full potential of renewable energy in manufacturing.

Main barriers faced by manufacturers in adopting renewable energy solutions.

The transition towards renewable energy in the manufacturing sector is pivotal for achieving sustainability and reducing global carbon emissions. Despite the clear benefits, manufacturers encounter several barriers in adopting renewable energy solutions. Technological challenges are at the forefront (Barman et al, 2023), with the variability and intermittency of renewable sources like solar and wind posing significant issues for continuous manufacturing processes that demand stable and reliable energy supplies. The current state of energy storage technology, although advancing, still falls short in terms of cost-effectiveness and efficiency for large-scale industrial use (Elahi et al, 2022).

Economic and financial constraints further complicate the picture. The initial capital investment required for renewable energy systems is substantially higher compared to conventional energy sources. This is particularly challenging for small and medium-sized enterprises (SMEs) that may have limited access to capital. The absence of clear financial incentives and supportive policies from governments exacerbates this barrier, rendering the return on investment uncertain and less attractive (Al-Emran, Griffy-Brown, 2023). Regulatory and policy frameworks also present hurdles. Inconsistent and unclear policies, along with cumbersome permitting and approval processes, can deter manufacturers from pursuing renewable energy projects. The lack of standardized regulations across different jurisdictions adds another layer of complexity, increasing the risk associated with renewable energy investments (Hassan et al, 2023).

Knowledge and information gaps about renewable energy technologies among manufacturers constitute another significant barrier. Many in the industry are not fully aware of the potential benefits and applications of renewable energy within their operations, nor do they understand the technical, economic, and regulatory nuances involved in making the transition (Igbinenikaro et al, 2024).

Cultural and social factors play a role as well. Resistance to change and skepticism about the reliability and effectiveness of renewable energy solutions can hinder their acceptance and implementation. The manufacturing sector's traditional reliance on fossil fuels is deeply ingrained, making the shift to renewable energy not just a technological challenge but a cultural one (Ali et al, 2023). Finally, the existing energy infrastructure in many regions is ill equipped to accommodate the decentralized nature of renewable energy generation. Integrating renewable sources into the grid requires significant modifications to existing networks and the development of new transmission and distribution systems, which can be both complex and costly.

Integrating renewable resources into the production network to prevent energy waste in this sector and make it more efficient requires significant changes to existing networks and the development of new transmission and distribution systems, which can be complex and costly. Overcoming these obstacles requires a coordinated effort from

all stakeholders. Researchers, governments, industry leaders, and financial institutions must work together to create an enabling environment for research and development, create clear policies, and foster a culture of innovation and sustainability. The present study was conducted to provide solutions to address the problems of energy waste in the manufacturing sector in Iran. Since the renewable energy approach to preventing energy waste in the manufacturing industry has attracted much attention from researchers outside Iran, but no comprehensive study has been conducted in Iran so far, the contribution of the present study will be to identify sources of energy waste in the manufacturing sector and provide opportunities for innovation, cost savings, and environmental benefits through renewable energies. This study proposes a new approach to preventing energy waste in the manufacturing industry.

Hypotheses

In this part of the study, the research hypotheses will be developed according to the existing literature.

The integration of renewable energy solutions into existing infrastructures presents both technical and infrastructural challenges that must be addressed to ensure a smooth transition towards sustainable energy systems. Kataray et al (2023) discuss the integration of smart grids with renewable energy sources, emphasizing the opportunities and challenges presented by this combination. The review identifies communication networks and appropriate demand-side management with suitable algorithms as crucial for the successful integration of smart grids with renewable energy. The study also addresses the evolution of Indian energy legislation and regulations, highlighting the main barriers to smart grid integration and offering policy recommendations based on the assessment (Kataray et al., 2023). Vries and Verzijlbergh (2018) present a systematic review of the challenges to the regulation of electricity markets posed by the integration of variable renewable energy sources. The study develops a framework for analysing the need for coordination between aspects of power sector regulation to achieve economic efficiency. It identifies institutional fragmentation as a significant challenge in Europe, where variable renewable energy requires closer coordination between countries, different levels of the electricity system, and markets serving different time scales (Vries & Verzijlbergh, 2018). Yıldızbaşı (2021) explores the integration challenges of blockchain technology with renewable energy systems within the circular economy perspective. The study discusses how blockchain can address issues in energy grid management, such as efficient distribution, illegal energy use, and the entry of individual energy producers into the market. However, it also highlights the challenges faced during integration, including the complexity of energy distribution networks and the need for a novel integration process to ensure sustainability (Yıldızbaşı, 2021). The integration of renewable energy solutions into existing infrastructures faces several technical and infrastructural challenges, including power quality issues, the need for effective demand-side management, regulatory fragmentation, and the integration of innovative technologies like blockchain. Addressing these challenges requires coordinated efforts between policymakers, industry stakeholders, and technology developers to develop and implement effective mitigation strategies, ensuring the successful transition towards sustainable energy systems (Alamshahi et al, 2024). Considering the above, the first hypothesis of the research is presented as follows:

1- Improving the infrastructure related to renewable energy in the production sector can be a solution for the use of renewable energy in the production sector.

In today's world, the volatility of fossil fuel prices and the potential for regulatory changes that favor sustainability have created additional motivation to adopt renewable energy solutions (Xin et al., 2022). the opportunities afforded by renewable energy

for the manufacturing sector are substantial. Beyond the environmental benefits, renewable energy can confer economic advantages through operational cost savings, enhanced energy security, and improved compliance with regulatory standards. Furthermore, companies that proactively embrace renewable energy can bolster their corporate reputation, aligning with consumer and stakeholder expectations for sustainable practices. The body of research on renewable energy in manufacturing underscores the importance of policy support, technological innovation, and cross-sector collaboration in overcoming barriers to adoption. Incentives such as tax breaks, subsidies, and grants play a crucial role in enhancing the economic viability of renewable energy projects. Meanwhile, ongoing advancements in technology are progressively addressing the challenges of cost, efficiency, and integration, paving the way for broader implementation across the manufacturing industry (Xin et al., 2022; Kılçı, 2022). The transition to renewable energy in the manufacturing sector is not merely a response to environmental imperatives but a strategic investment in the future. The path forward requires concerted efforts from industry stakeholders, policymakers, and the research community to navigate the complexities of this transition. By fostering an environment conducive to renewable energy adoption, the manufacturing sector can significantly contribute to global sustainability goals, ensuring a cleaner, more resilient future. Considering the above, hypotheses 2 and 3 of the research are presented as follows:

2- Paying the initial costs of adopting renewable energy technology in the production sector can be a solution for the use of renewable energy in the production sector.

3- Policy support, technological innovation and inter-sectoral cooperation in renewable energy technology in the production sector can be a solution for the use of renewable energy in the production sector.

Globally, renewable energy sources such as solar, wind, biomass and geothermal are considered the most effective solutions to energy optimization and environmental problems (Osman et al. 2022). The transition to renewable energy sources creates new jobs and reduces carbon dioxide emissions. Since renewable energy sources produce natural fuels, they can provide a sustainable energy source with minimal operating costs and regular energy supply. On the other hand, renewable energy sources do not have any harmful impact on the environment and, in addition, renewable energies such as solar, wind and tidal energy require minimal amounts of water for production, which can contribute to saving water resources (Tanaka et al. 2022).

However, the unstable availability of renewable energy sources, which depends on weather conditions, such as the availability of wind and solar radiation, is a major limitation. Energy storage systems can partially overcome this gap, but the overall cost and energy conversion efficiency are low (Elkadeem et al. 2019). In general, renewable energy sources may prevent energy waste. Considering these issues, Hypothesis 4 is presented as follows:

4- The use of renewable energies in the production sector (such as the sun, wind, and biomass) can prevent energy wastage.

Today, countries around the world are actively increasing their efforts in energy innovation to decarbonize the global energy grid and achieve energy waste prevention goals. The new wave of the Industrial Revolution 4.0 has contributed to this as investors and manufacturers have kicked off the trend by turning their attention to energy-related technological innovations that can help design smart energy grids for today's and tomorrow's needs. This development, among other things, has already led to the implementation of a number of technological innovations that can increase the use of renewable energy sources, such as the deployment of AI-based robots to monitor the efficiency of hydroelectric power plants and reduce maintenance costs. Hydroelectric

battery hybrids to improve grid services, and the adoption of a "Hyperloop for Fish" to safely transport fish from dams (International Hydropower Association, 2021). Despite the advent of the Fourth Industrial Revolution (4IR) and its advancements, the development of these innovations requires significant investment and thus, there is a need to assess their effectiveness in terms of real contribution to achieving the decarbonization agenda through promotion. Despite the need to investigate the real end result of the impact of technological innovations on the advancement of renewable energy sources, empirical exercises in this area have been relatively inactive, as most research efforts have mainly focused on the development of these innovations without measurement. Therefore, the present study formulated the following research hypothesis number 5:

5- The use of new technologies related to renewable energies in the production sector can play a mediating role in preventing energy waste in the production sector.

Achieving energy efficiency is a process that requires technological changes in facilities and conscious choice of energy type (Chebotareva et al, 2020). In today's world, with the current state of technological progress, most facilities and technologies are now specifically built to provide energy efficiency and prevent its waste (Mohatdi et al, 2022). Saving energy can also help the manufacturing sector save money, and conscious daily actions can also reduce energy costs (Didekhani et al, 2019). Considering this, Hypothesis No. 6 of the research is formulated as follows:

6- Preventing energy waste in the production sector can provide economic benefits in the production sector.

According to the formulated assumptions, the conceptual model of the current research is as follows:
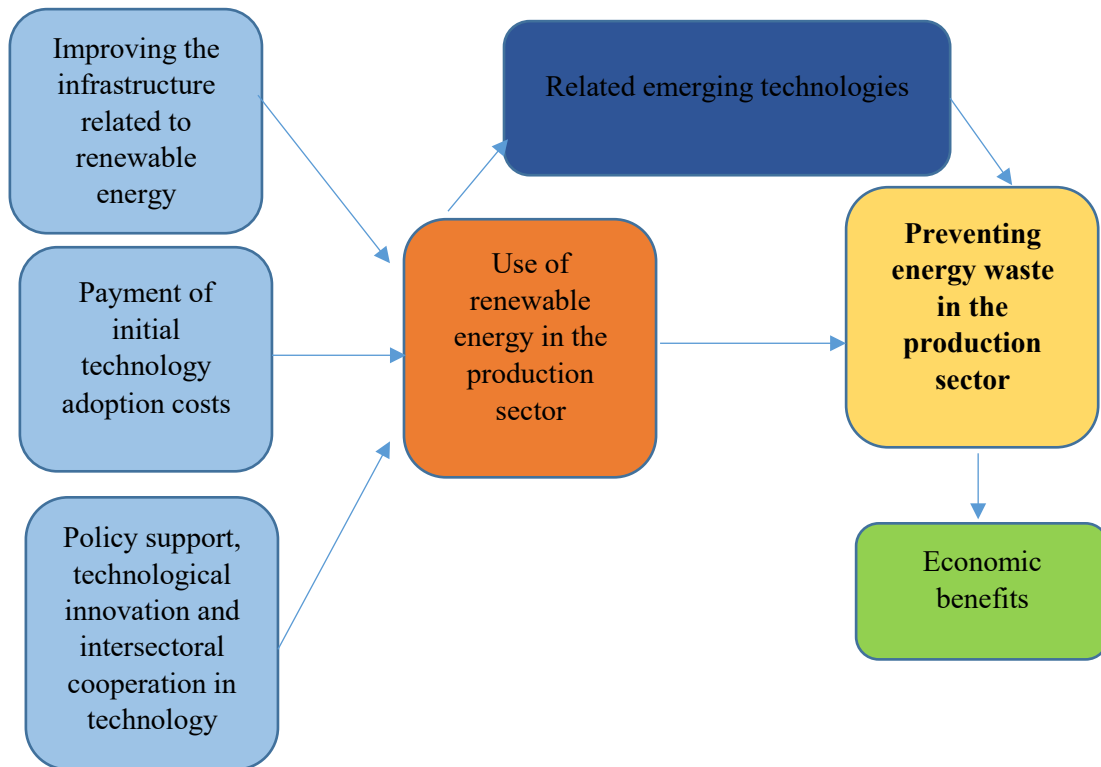
Figure 2. *Conceptual model of research*

Methodology

The present study was conducted in the field of mixed research and based on quantitative and qualitative data. Also, this

study was applied in terms of purpose and library-survey in terms of data collection. The statistical population is all energy specialists in the manufacturing industries of companies affiliated with the Iranian electronics industry located in Shiraz. The sampling method was snowball. Based on this method, the number of samples for the study has reached 148 people. In order to collect data related to each of the research variables, a questionnaire with a total of 21 questions was used. Also, Smart-PLS software was used to analyze the data and test the hypotheses.

Findings

In this research, Smart-PLS software was used to investigate the relationships between variables using inferential statistics and depending on the type of data distribution. Also, the hypothesis of this research has been tested using confirmatory factor analysis. The most important goal of confirmatory factor analysis is to determine the power of the predefined factor model with a set of observed data. In other words, confirmatory factor analysis seeks to determine whether the number of factors and the variable loadings measured on these factors are consistent with what was expected based on the theory and theoretical model. In order to achieve the final results of the hypothesis test, various steps were carried out to check the preparations and prerequisites of the test, which include checking the fit of the model, which includes the following sub-structures: 1. measurement models, 2. structural model, and 3. general model, and testing the hypotheses through Examining the standardized coefficients of the paths related to the hypotheses and examining the significance coefficients of Z related to each of the hypotheses. Also, to check the fit of the measurement model, three reliability criteria of the index, convergent validity and divergent validity are used. As can be seen, in

all model structures, factor loads have values above 0.4; Therefore, the reliability of the measurement models is acceptable, which indicates the appropriate fit of the measurement model. According to the algorithm of data analysis in the method of partial least squares (PLS), now it is the turn to examine Cronbach's alpha coefficients and composite reliability. Cronbach's alpha coefficients and composite reliability of constructs express the ratio of variance between each construct and its indicators to the variance of the whole construct. Cronbach's alpha and reliability coefficient higher than 0.7 are considered acceptable. According to the results, all the factors have an acceptable combined reliability coefficient. Also, Cronbach's reliability coefficient is acceptable; Therefore, it can be concluded that the research questionnaire has good reliability. As a result, the appropriateness of the measurement model is also confirmed. Divergent and convergent validity were also confirmed.

Examining the fit of the research model

The examination of the fit of the model is done in three parts: measurement model, structural model and general model to check to what extent the research model fits the data collected from the statistical sample. After confirming the fit of the model, the researcher is allowed to examine and test the research hypotheses. Smart PLS software, after obtaining the data related to the variables, presents the final model of the research, which includes most of the analysis, in the form of Figure 3. In the mode of estimating the standardized coefficients and Figure 4. The model in the mode of significant coefficients t, which all Analysis and fitting of measurement, structural and general models and hypothesis testing are done based on these outputs.
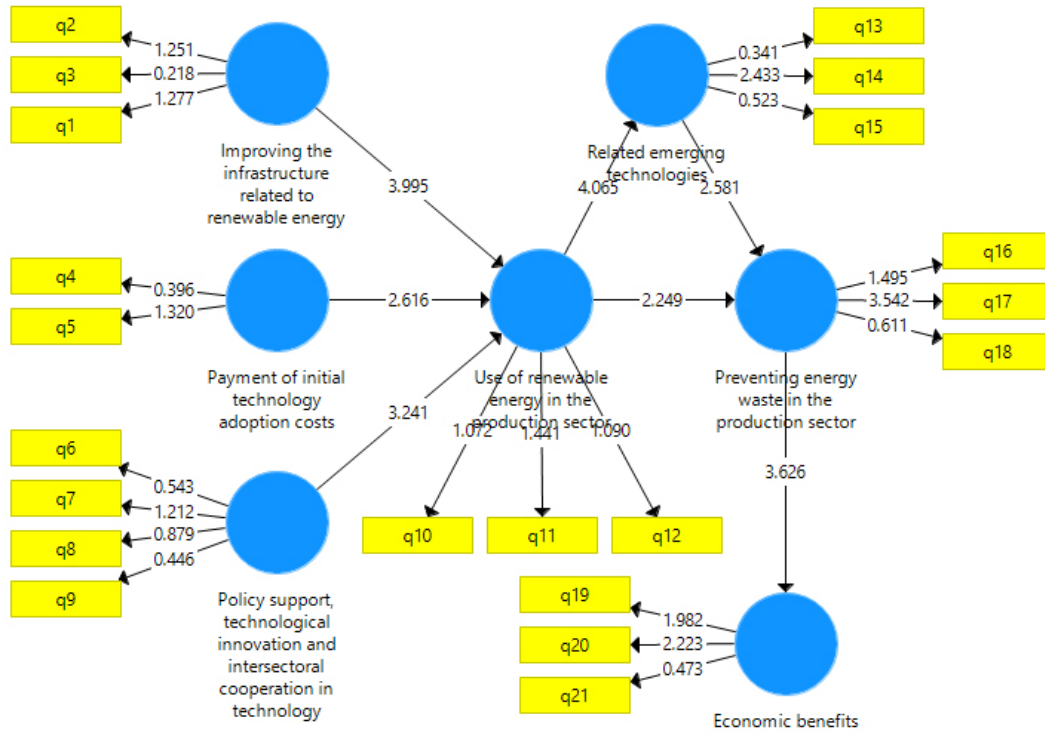
Figure 3. *The final model of the research in the mode of estimation of standardized coefficients*
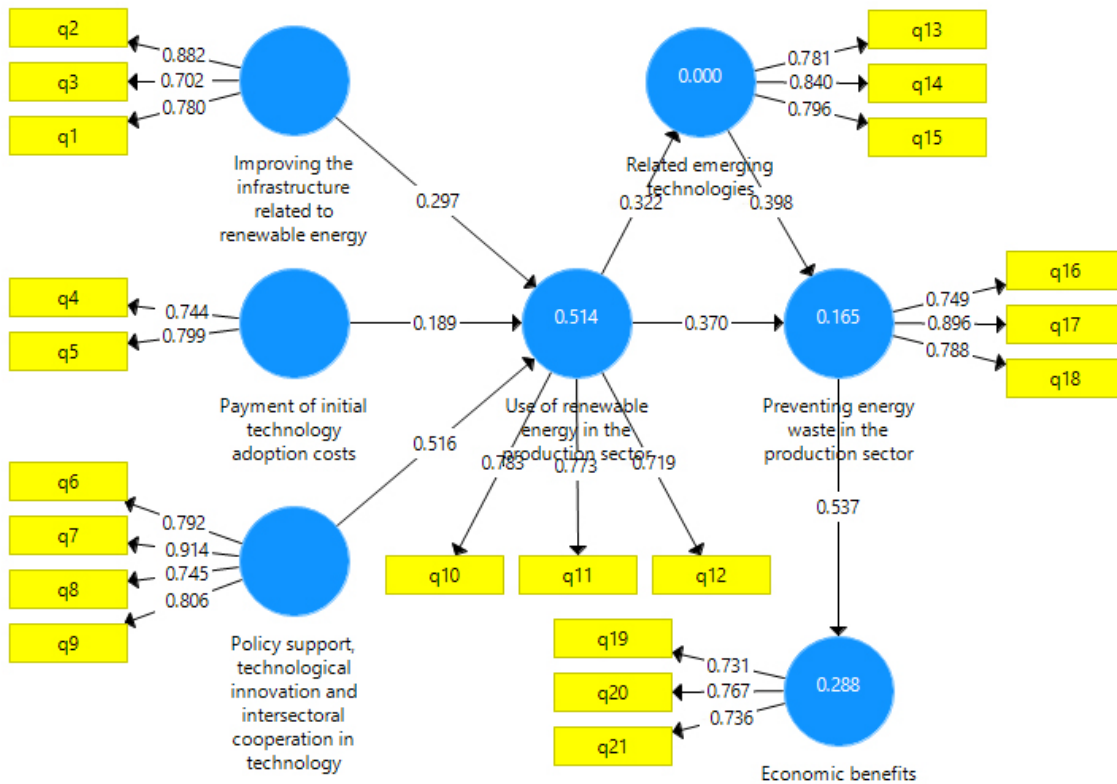

Figure 4. *The final research model in the case of significant coefficients*

Overall model fit

In this section, the fit of the overall model is examined based on the GOF criterion. According to the average shared values of the constructs (shared values of the first order constructs) and the average R2 of all the endogenous constructs of the model, the GOF value for the overall fit of the current research model is equal to:

$$GOF= \sqrt{\overline{AVE} \times \overline{R^2}} = \sqrt{0.807 \times 0.351} = 0.532$$

According to the three introduced criteria values of 0.01, 0.25 and 0.36 as weak, medium and strong values, obtaining a value of 0.532 for GOF shows the strong overall fit of the research model.

According to the strong overall fit of the presented model, in Table No. 1. The results of the hypothesis test are presented. According to the structural model of the research in the case of significant coefficients, if it is observed that the t-statistics between two variables in each hypothesis is not in the range (1.96 & -1.96), then the hypothesis is accepted, otherwise the hypothesis is not accepted.

Hypothesis testing

Table 1.
Results

Hypothesis	Description	T Statistics
OK	Improving the infrastructure related to renewable energy -> Use of renewable energy in the production sector	3.995
OK	Payment of initial technology adoption costs -> Use of renewable energy in the production sector	2.616
OK	Policy support, technological innovation and intersectoral cooperation in technology -> Use of renewable energy in the production sector	3.241
OK	Preventing energy waste in the production sector -> Economic benefits	3.626
OK	Use of renewable energy in the production sector -> Preventing energy waste in the production sector	2.249
OK	Use of renewable energy in the production sector -> Preventing energy waste in the production sector -> Preventing energy waste in the production sector	2.249

Discussion and Conclusion

The present study examines the energy waste in the production industry and the strategies for the development of renewable energy in the production sector. Based on the results of the analysis of research hypotheses, the modification of the infrastructure related to renewable energy, the payment of the initial costs of technology adoption, policy support, technological innovation and inter-sectoral cooperation in technology can be among the solutions for the development of renewable energy in the production sector. be It has also been shown in this research that the use of new technologies related to renewable energy in the production sector can play a mediating role in preventing energy wastage in the production sector and preventing energy wastage in the production sector can have economic benefits. have in front These results are in line with Yin et al.'s (2022) results, which state that to reduce energy waste, companies tend to use new digital technologies or update their technologies. Also, this finding shows that the reduction of energy waste is only related to the development of technology, which ultimately leads to the narrowing of experts' views on the reduction of production energy consumption.

As the global community grapples with the escalating challenges of climate change and environmental degradation, the manufacturing industry emerges as a pivotal arena for transformative action. This sector, traditionally energy-intensive and reliant on fossil fuels, is under increasing pressure to reduce its carbon footprint and embrace sustainability. The transition to renewable energy sources represents a critical pathway towards achieving these objectives, offering the dual benefits of mitigating environmental impact and ensuring long term economic resilience.

The rationale for this shift is multifaceted, rooted in both environmental necessity and strategic advantage. The manufacturing industry is a significant contributor to global greenhouse gas emissions, underscoring the urgent need for cleaner energy practices. Renewable energy technologies, such as solar, wind, and biomass, provide viable alternatives that can substantially lower emissions and reduce reliance on non-renewable resources.

Moreover, the volatility of fossil fuel prices and the potential for regulatory changes favoring sustainability further incentivize the adoption of renewable energy solutions (Taboada et al., 2012; Xin et al., 2022). Despite the clear benefits, the integration of renewable energy into manufacturing processes presents a complex array of challenges. These include the initial costs of technology adoption, the need for infrastructure modification, and the requirement for skilled personnel to manage and maintain new energy systems. Additionally, the intermittent nature of some renewable energy sources, such as solar and wind, necessitates innovative approaches to energy storage and demand management (Taboada et al., 2012).

Nevertheless, the opportunities afforded by renewable energy for the manufacturing sector are

substantial. Beyond the environmental benefits, renewable energy can confer economic advantages through operational cost savings, enhanced energy security, and improved

compliance with regulatory standards. Furthermore, companies that proactively embrace renewable energy can bolster their corporate reputation, aligning with consumer and stakeholder expectations for sustainable practices.

The body of research on renewable energy in manufacturing underscores the importance of policy support, technological innovation, and cross-sector collaboration in overcoming barriers to adoption. Incentives such as tax breaks, subsidies, and grants play a crucial role in enhancing the economic viability of renewable energy projects. Meanwhile, ongoing advancements in technology are progressively addressing the challenges of cost, efficiency, and integration, paving the way for broader implementation across the manufacturing industry (Xin et al., 2022; Kılçı, 2022).

The transition to renewable energy in the manufacturing sector is not merely a response to environmental imperatives but a strategic investment in the future. The path forward requires concerted efforts from industry stakeholders, policymakers, and the research community to navigate the complexities of this transition. By fostering an environment conducive to renewable energy adoption, the manufacturing sector can significantly contribute to global sustainability goals, ensuring a cleaner, more resilient future.

Management Suggestions

Conducting an energy audit is a critical first step in any comprehensive energy management strategy. It provides an overview of how energy is being used in a facility, pinpointing inefficiencies and identifying energy saving opportunities for businesses. It is therefore recommended that each manufacturing unit initially have a plan to audit its various departments. Each manufacturing unit should also initially identify the sources of energy consumption. All major energy consuming systems in the facility, such as HVAC, lighting, machinery and compressed air systems, should be mapped so that managers and professionals know where energy is being consumed. On the other hand, it is essential to identify energy wastage points in each manufacturing unit. For example, leaks in compressed air systems, inefficient lighting, or outdated equipment that consumes more energy than necessary can be the target points.

Energy-efficient manufacturing processes and energy systems should be continuously evaluated. Any operating practices that lead to unnecessary energy use should be identified.

Plant managers should use the collected data to establish an energy baseline, which

serves as a reference point for measuring the impact of future energy efficiency measures and improvements.

Energy analysis in the audit leads to advanced diagnostics and insights that can identify more subtle opportunities for energy optimization and efficiency improvements. This ensures that plants are implementing the most effective energy efficiency measures, driven by data-driven insights and supported by BECIS' comprehensive range of energy solutions.

Ultimately, plant managers should look to renewable energy and related infrastructure improvements to achieve specific, cost-effective energy efficiency goals.

Suggestions for Future Research

More research could be done to study energy waste in real factories with case studies of renewable energy and leading solutions, which could lead to a more precise framework for categorizing different types of energy waste and linking them to solutions. Existing renewable energies help.

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